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ABSTRACT

Educational research has documented that technology can enhance student acquisition of discrete skills through drill and practice. This document presents case-study profiles from a study that examined whether technology could provide significant support for constructivist, project-based, teaching and learning approaches. The study also identified the elements necessary for the effective implementation of technology within an educational reform context. Data were derived from case studies that were conducted at nine sites whose programs emphasized education reform and provided authentic activities for students from economically disadvantaged backgrounds. The sites, 8 individual schools and 1 network of 462 schools, were selected on the basis of the following criteria: (1) the strength of the site's education reform agenda over technological use for its own sake; (2) the involvement of large numbers of students from economically disadvantaged backgrounds, representing a variety of cultures, ethnic groups, and linguistic experiences; and (3) the use of network and other distance-learning technologies. (LMI)

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ED 397 560

August 1994

TECHNOLOGY AND EDUCATION REFORM: CASE STUDY REPORTS

DRAFT

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Researchers' Note

This document contains draft case-study write-ups for the nine sites selected for the Studies in Education Reform: Technology Project.

The sites described here reflect our selection criteria which emphasized:

- the strength of the site's education reform agenda over technology use for its own sake,
- involvement of large numbers of students from economically disadvantaged backgrounds, representing a variety ofcultures, ethnic groups, and linguistic experiences, and
- use of network and other distance learning technologies.

Earlier versions of these case study descriptions have been sent to the sites and nearly all of them have responded with corrections and comments.

To preserve the anonymity of the sites and informants, pseudonyms have been used for schools and generic descriptors or initials have been used for state and local government offices and for individuals.[1]

To assist readers in selecting cases of interest, Exhibit 1 on the following page lists each of the case pseudonyms along with information about the sites' student body, setting, and geographic region.

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[1] Material from these case study reports will be used in other dissemination products that feature site and individual names, but only after site review and approval of those products.

EXHIBIT 1

Case Study Sites

SITE	GRADE LEVEL	STUDENT BODY	SETTING	REGION
Bay Vista Elementary School	Elementary	87% minority; 68% ESL	Suburban	West
East City High School, ACOT	Secondary	35% African American; 40% free or reduced lunch	Urban	Midwest
John Wesley Elementary School	Elementary	86% Hispanic; 64% LEP	Suburban	West
Maynard School	Elementary 4-6	Low-SES; 71% African American; 27% Hispanic	Urban	Northeast
Nathaniel Elementary School	Elementary	Low-SES; 95% minority; 59% LEP	Urban	West
Progressive School	Elementary	61% minority; wide SES range	Urban	West
School of the Future	Middle	Wide SES range; 67% male	Urban	North Central
South Creek Middle School	Middle	60% Hispanic; 65% free lunch	Suburban	Southwest
Teachernet	All	Varies across schools	Rural/Urban/ Suburban	Midwest

BAY VISTA ELEMENTARY SCHOOL DEBRIEFING

Site: Bay Vista Elementary School

Point of Contact: L. M.

1.0 Summary [*sum*]

Bay Vista is a state Model Technology School in the area of science. The Bay Vista program places an emphasis on hands-on science experiences, collaborative learning, and higher-order skills as well as on the use of technology. In many ways, Bay Vista is a fairly traditional elementary school serving an ethnically diverse, primarily lower-middle class student population. What sets Bay Vista apart is the extent to which there is coherence across grade levels, subject areas, and classrooms. Technology took root here because of the efforts of a group of teachers who were "early adopters" and who capitalized on opportunities for support from the district and state. The teachers continue to make their program of collaborative learning, science themes, and technology work by putting in the extra time and effort to try new things and to communicate with each other.

2.0 Context and Reform Overview

2.1 Educational Context. *[context]*

Setting. Bay Vista Elementary School is located in a lower-middle-class neighborhood of homes and apartments along the border between two urban cities. Many of the students' parents are employed in industries related to the nearby city airport (e.g., airplane maintenance or hotel industry). Like the houses and apartments surrounding it, the school's physical facility is modest but neat and clean. The school is located near a major thoroughfare running along the hillside. The area offers impressive views but is regarded as less than ideal because of the airport noise, cold, and fog.

Grade levels. Grades K-5 currently; grades K-6 until 1993-94 when the district went to middle schools.

2.2 Demographic Information [*demo*]

Underline applicable unit: School Class Project District Other:

Number of certified teachers (FTE): 19 regular teachers

Enrollment as of 9/93: 575

Number of percent free or reduced lunch: 25%

Number of percent LEP or NEP: 63 students (11%)

Number of percent special education: No pull-out special ed classes; 8 students identified

Ethnic Composition *(Number or percent in each category):*

9%	12%	11%
African American	Hispanic	Caucasian, Non-Hispanic
1%	67% (including 44% Filipino)	
Native American	Asian/Pacific Islander	

Estimated percent students w/computers in home: Over 50%

2.3 Education Indicators [*stats*]

Students score above the national average in reading, language, and mathematics. The 1992-93 scores on the Individual Tests of Academic Skills (ITAS) show fifth grade scores averaging at the 69th percentile for math, 59 for written English, and 64 for reading. Fourth graders were at the 68th percentile in all three areas.

The school had the highest scores in the district on the McAlister Writing Sample in 1992-93, which the principal regarded as a significant achievement, especially given the fact that Bay Vista had absorbed 200 students from closing schools.

2.4 Reform History [*reform*].

- Nature and when started *[history]*

  Bay Vista stands out in terms of the degree of coherence in its approach, its integration of technology across grade levels and subject areas, and in its use of some reform-related instructional approaches (e.g., hands-on activities). Many of the latter have been byproducts of the efforts to incorporate technology in meaningful ways. The Level II Model Technology School grant from the state, for example, involved implementing technology within a program emphasizing a particular curriculum area--science in the case of Bay Vista. The emphasis on hands-on science and integrating science with other parts of the curriculum as well as exposure to new science teaching materials and curricula are aspects of the Model Technology Schools activity, which is called TOPS (Technology Optimizes Performance in Science). Another influence has been the state education department, through curriculum frameworks and grant programs emphasizing higher-order thinking, hands-on approaches, and integration across subject areas.

Bay Vista has not attempted any radical changes in its basic structure. For example, the teachers discussed the possibility of doing some multiage grouping several years ago and rejected the idea on the grounds that it would require too many organizational and structural changes. Nevertheless, the projects the school has undertaken have provided a degree of flexibility that has helped to break down some of the barriers between classes and subject areas. For example, by funding a project coordinator position and materials for a hands-on project room, these projects have provided a place where teachers can bring their students for a team-taught lesson (by the teacher and the project coordinator) or to be taught by the coordinator. Such activities have allowed teachers to view how other teachers handle hands-on science activities, collaborative groups, and the integration of technology. The science coordinator has been available also to take over classes, giving the teacher an opportunity to view a special lesson or technology demonstration in another Bay Vista class or at another school. Opportunities to view each other teaching lead to more consistency and connections across classrooms. All of the small-group lessons we observed, for example, used the same group structure with distinct role assignments. We also observed teachers, club leaders, and students making references to content and activities from other classes.

- Reform Features [***feature***] (mark all that apply)

  Nongraded groupings
  X Teacher professionalization
  Extended periods
  X Authentic assessment
  X Schoolwide themes
  X Use of outside resources

- Key Individuals [***key***]

  Same as for technology development. Key players have been teachers , principals , and district staff. In addition to her strong support for TOPS, the current principal (D. P.) is moving the school toward more use of performance-based assessment.

- Funding sources for reform **[*funds*]**

  Same as for technology (mostly state grants, district grants of Chapter 2 funds, and donations) plus state School Improvement Plan (SIP) funds of $68K ($83 per student), which are used to support improvements in math, language arts, and visual and performing arts. The School Site Council provides input into how these funds are spent.

- District involvement/support **[*localref*]**

  The city's Unified School District made a concerted effort during the 80s to implement a teachers-teaching-teachers program and to help set up each school as a leader in some area. For Bay Vista, the area was technology. The district set up opportunities for Bay Vista teachers to become mentors in technology and supported Bay Vista teachers as they began writing grants for outside funding. One of the district staff, J. K. reports that in his district position, he regarded grant writing as a professionalization opportunity for teachers--stimulating them to think about what they wanted to accomplish in the classroom and to collaborate with each other. At the time, his sense was that most of the funding opportunities were in the area of technology and he steered Bay Vista teachers toward these opportunities and helped them write proposals.

- State/federal involvement/support **[*stateref*]**

  The state has influenced Bay Vista through grants programs, curriculum frameworks, and the state assessment program. Bay Vista teachers have been active in many state initiatives, including the state's Science Project, development and field testing of science and math portions of the state's new Learning Assessment System (LAS), and planning and conducting the statewide Technology Leadership Academy for science and social science. They participated in the state's Educational Technology Summit to organize and develop a statewide technology plan.

  Bay Vista is not a Chapter 1 school. Chapter 2 funds have been used to purchase hardware and software. The district instituted a policy of using Chapter 2 funds to set up district mini and maxi grant programs. Rather than an entitlement, Chapter 2 funds were something that schools could compete for and win on the basis of the quality of their idea and proposal.

- Role of tech in reform efforts **[*techre*]** *(classify and describe)*:

X Part of initial reform concept   Emerging part of reform efforts   Parallel effort

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*]

The technology innovations at Bay Vista were initiated by a core of teachers who were interested in technology and believed that it had potential for teaching students how to think. Initial projects thus had a higher-order thinking skills flavor. This interest was supported by state grants programs and a federal grant which supplied funding to the school for technology innovations and dissemination. Today, teachers seem to give at least equal weight to the motivational value of technology and the need to prepare students for a technology-laden world.

3.2 When & How Application Started [*how*]

Bay Vista's implementation of technology reflects a confluence of factors--a tightly knit group of teachers who were early computer users and willing to expend their energies in grant-writing and training to spread computers to other classes, a supportive principal (B. C.), and a district that offered support both for training and for the development of grant proposals. In 1979, several of the Bay Vista teachers (notably B. E. and B. D.) took a class on computers and got excited about the prospect of using them to teach thinking skills. With the principal's support, Title IVB (now called Chapter 2) funds were used to purchase a computer for the school. The principal set the goal of getting as many students on the computer as possible. In 1981, the city's School District set up the Computer Cadre, within which the two teachers (B. E. and B. D.) were active members. At first the Cadre was limited to Bay Vista but later it became district wide. Along with J. K., the district staffer responsible for both technology and grant writing, they were able to get the state funding for a project called CompuTHINK. This project led them to apply a task analysis framework to software such as *Rocky's Boots* to look for material that would help teach specific thinking skills. They wanted to use the computers as broadly as possible across the school. The school was departmentalized and had a problem-solving curriculum in grades 4-6. Given their purpose, this was a natural place to introduce technology. The grant funded a staff position, shared by the two teachers (B. D. and B. E.), who took on the chore of scheduling hardware and software, doing technical troubleshooting (both earned Apple Level I repair licenses), and training teachers. Students worked in groups on the computers.

In 1982, more Bay Vista teachers started using computers. The principal assisted in making arrangements so that B. D. and B. E. and other teachers could visit other computer-using schools. Another teacher set up a Computer Club as an after-school activity for fifth- and sixth-graders. By 1983, Bay Vista had 19 active computer-using staff members.

When the state announced the Level II Model Technology Schools (MTS) grant program for specific subject areas, Bay Vista was interested. By this time they had considerable experience in the use of technology and also felt that they had a trump card in L. M.'s science expertise. L. M. had participated in a federally funded project using laser disc and other technology to support science instruction (the SITE program). They felt, however, that most of their internal efforts had been in the language arts area and that there was much room for improvement in what they were doing in science. In 1987 they wrote the proposal for their MTS grant. The proposal was funded the next year, and the grant supported a project coordinator position (shared by L. M. and B. D.), provided for a central repository for science software and curriculum materials, and provided for special activities and professional development.

The program that Bay Vista developed—Technology Optimizes Performance in Science or TOPS—had four main goals:

- Develop students' critical thinking skills within the science curriculum
- Improve student achievement and knowledge in science
- Increase student interest and motivation in science
- Convince teachers of the benefits of using technology and hands-on experience to teach science.

After two years of development, TOPS was reviewed by the state department of education, certified as "curriculum aligned", and funded for dissemination activities. The dissemination funding began in January 1990 and will continue through September 1994. The dissemination funding covers a project coordinator position and a part-time consultant to maintain a model site for visits and training and to provide consulting to schools adopting or adapting portions of the TOPS program. By 1993, 55 projects adapting TOPS had received educational technology grants from the state department of education.

3.3 Technologies Used [types] *(give numbers for hardware)*

X • Microcomputers (17 Macs; 14 networked & 1 stand-alone IBM; 25 Apple IIs)
X • Word processing
X • ILS
X • Other LANs (network of 14 IBMs)
X • WANs
X • CD-ROM (3)
X • Interactive videodisc
X • Videocams and editing equipment
X • Other (1 Macro/Micro; 3 sets of Probeware; 10 robotics sets)
X • Spreadsheet
X • Hypermedia (licensed for 13 computers)
X • Animation
X • Simulation

3.4 Target Grades & Curricula [*levels, curric*]

The TOPS program extends throughout the elementary school (originally K-6, now K-5) and has also been adapted in part by middle and secondary schools. Although the TOPS project per se focuses on science, the technology introduced by the grant is used also in language arts, mathematics, social studies, visual and performing arts, and problem-solving curricula.

3.5 Key School Players [*infield*]

The Bay Vista innovation is interesting in terms of the sheer number of staff members who have had important involvement in its design and implementation. The two key individuals most frequently cited in terms of getting the program started are **B. D.** and **B. E.** These teachers took computer courses early on and advocated for and demonstrated the use of technology to teach higher-order thinking skills. They offered in-services, did all the detail work of scheduling shared computers, and learned how to do basic computer maintenance. They became active in regional and state networks of educators using technology, and helped to pull in their Bay Vista colleagues. For example, B. D. established a connection with the state's Software Clearinghouse, and she has arranged for many of Bay Vista's teachers to get involved in reviewing new software (which leads to their receiving free copies and also has greatly enhanced the teachers' knowledge of software options and ability to critically select software). Although B. D. has taken a district position this past year, she continues to be involved in the program. B. E. is still teaching at Bay Vista, and does the scheduling for the Macintosh and Apple gs computers (which are rolled on individual carts from class to class).

At the time of the development of the MTS grant proposal, **L. M.** became a key player for her expertise in the science teaching area. L. M. has also been an active technology user, and in addition to coordinating visits, schoolwide activities, and demonstrations under the dissemination grant, managing the software collection, and doing demonstration science-technology lessons, she teaches the MultiMedia Club, in which students learn to use HyperStudio.

Among administrators, **J. K.**, previously of the city's district office and later the County Office of Education, was a key player. J. K. was very knowledgeable about state priorities and funding opportunities in the technology area, was a major author of Bay Vista's grant proposals, and helped to shape the teachers' thinking. **C. D.** at the district office in currently the official Project Director for TOPS and although he has many other duties, is a supporter and link between the school and the district. The principal at the time the technology implementation got going, **B. C.**, was also frequently cited as an important player. She supported the acquisition of computers and release time for teachers to view how technology is used in other classrooms. Her successor, **E. F.**, was another project supporter who worked to make sure that teachers got professional development opportunities and that all teachers got recognized for their contributions, whether large or small. Her successor did not demonstrate an interest in technology, and did not actively recruit teachers who would use the extensive technology available at Bay Vista. The current principal, **D. P.**, now in her second year, is an avid technology user and another TOPS supporter. Recent hires have been teachers interested in technology use, and D. P. supports the Bay Vista tradition of giving teachers the opportunity to observe each others' work (often by having the TOPS coordinator fill in), extracurricular activities related to technology (Parents' Technology nights, Invention Convention, Video and MultiMedia Clubs), and professional development activities (e.g., participation in Computer Using Educators, technology carnivals).

3.6 Outside Players in Technology Application [*outfield*]

- District involvement ***[distr]***

  The city's Unified School District had a strong influence on the Bay Vista technology implementation. The district set the goal in the early 80s of equipping all schools with computers and training staff to use them. The district set up the Computer Cadre in 1981 to review hardware and software options and plan inservice training within the district. The district's coordinator of special projects and research (J. K.) secured $915K of outside funds, including $122K specifically earmarked for hardware and software purchases between 1976 and 1983. Bay Vista was set up as the technology demonstration center for the district because of its base of interested computer-using teachers and the principal's and staff's interest in trying out new ideas. The district used the strategy of having one teacher in each district school with strong ties to the Bay Vista activities.

Bay Vista teachers were partners with the district in a number of technology-oriented grant proposals (e.g., CompuTHINK, TOPS). While at the district office, J. K. sought to help Bay Vista garner political support (e.g., bringing in the state's assemblyman who later nominated L. M. as a Christa McAuliffe educator; arranging for Bay Vista teachers to testify before the state assembly). Bay Vista staff continue to participate on the current district committee to develop a district technology plan (one of six areas in the district's evolving strategic plan). Relations between Bay Vista and the district office appear to be quite good, with lots of communication and mutual support.

Just after leaving the city's District Office for the County Technology Center, J. K. received a National Institute of Education (NIE) grant to develop the Science Integrates Technology Effectively (SITE) project. Although it involved several schools, Bay Vista was the "hub" for these activities. The project produced a guidebook for integrating technology into the grades 5-7 science curriculum. L. M. was one of the six "target teachers" for the project. This project was a forerunner for Bay Vista's TOPS proposal to the state.

- State involvement ***[state]***

The state has had an influence through its grants programs, curriculum frameworks, and assessment programs. The state's grant competitions for using technology to teach thinking skills and later using technology to support instruction within specific disciplines spurred Bay Vista teachers to further develop their ideas as they prepared grant applications. The school's current emphasis on science might never have become a schoolwide thrust if it weren't for the state Level II MTS grant initiative. Certainly, Bay Vista would have nowhere near its current level of technology available if not for these special state funding programs. (The district has spent relatively little on the acquisition of hardware and software per se.) The state science framework--which stresses conceptual learning over rote memorization of facts, integrating science with other topics, making use of community resources, a balanced curriculum of physical, earth, and life sciences, and showing students that science is enjoyable--has been used in designing TOPS activities. The state's emphasis on writing assessment has reinforced Bay Vista's use of word processing software and its stress on teaching composition and revision from the earliest grades.

- Business involvement ***[bus]***

In conjunction with the AMTEC coalition set up to support the state's Level II model technology projects, IBM donated $80,000 in equipment, software, and training (including a lab of a dozen or so computers) in return for Bay Vista's serving as a testbed for some of its instructional software and producing a videotape and brochure illustrating the use of Probeware. As part of this partnership, Bay Vista developed a videotape and booklet on using Probeware. Bay Vista also received donations and training from a number of vendors: Optical Data Corporation, Video Discovery, Tandy, Scholastic, EmCal, Youth in Motion, National Geographic, Sunburst, Broderbund, and South West Publications. A local cable television station participated in a partnership in 1992-93 which permitted Bay Vista Video Club members to show their work on cable television and to visit the local studio as well as providing materials and technical assistance in video production (the partnership was not continued because the studio wanted a school in its own city).

- Federal Involvement

  Chapter 2 funds have been used to purchase hardware and software. These funds were allocated by the district through local grants programs.

- Foundation involvement ***[foundtn]***

  No foundation support for the school's program per se, but NEA's National Foundation for the Improvement of Education (NFIE) did designate L. M. as a Christa McAuliffe Educator, leading to her involvement in summer institute activities.

- Parent involvement ***[parent]***

  Parent involvement is a strength at Bay Vista. In part, the school is blessed with parents who place a high value on education. This does not diminish, however, Bay Vista's credit for taking active steps to involve parents. There are many activities designed to bring parents into the school and to make them aware of the kinds of things their children are doing. There are monthly technology nights at which parents can learn to use the new technologies their children are using in class. There are also Science Nights at which parents are exposed to the kinds of hands-on science activities emphasized within TOPS. Last year's Technology Carnival attracted about 300 attendees. Another popular annual event is the Invention Convention, at which students show off things they have designed and built. A project newsletter supports communication. Parent volunteers assist with activities such as the computer lab, Life Lab, and the Technology Carnival. Parents have donated equipment and materials and have served as resources for class presentations.

- Other outside influences, including research

  Other influences include networks of teachers such as Computer Using Educators (CUE) and the National Foundation for Improvement in Education (NFIE), which named L. M. as a Christa McAuliffe Educator in 1988.

4.0 Overview of Tech Uses

4.1 Student Uses [*kiduse*]

- Tutorial

Software and Laser discs for Science and Math Lessons- The TOPS project maintains a large library of science software and L. M. is available to work with teachers to select appropriate technology materials for their curriculum units. Examples noted in a recent report include ESL students viewing "Dances of the Bees" from Scholastics' NOVA: Animal Pathfinders, kindergartners' use of a laser disc on sink or float from Optical Data's Primary Windows on Science, third graders using a laser disc with time-lapse photography of plant growth from the "Structure of Life" module of the Museum of Science FOSS Project science materials, and second graders' use of the linear measurement unit from Measurement, Time, and Money.

Keyboarding - Bay Vista students in 1st through 3rd grade use inexpensive, highly portable TypeWrite II machines (the machine displays a word, the student types that word, the word disappears and another word appears in the window for them to type) to learn keyboarding skills.

Remediation - The district funds a Tutorial Learning Center (TLC) which provides pull-out instruction with a very low student:teacher ratio (partially staffed with aides and parent volunteers) for students who are performing below grade-level. At Bay Vista the TLC uses a set of 8 IBM computers set up in the hands-on projects room. The students from a given grade have a scheduled time for TLC activities. In the observed sessions, the computer uses were mostly tutorial in nature. One set of students entered sentences dictated by the teacher; another used some children's writing software "Stories and More".

Make-up or Supplementary Lessons - Students who have missed a class or a particular lesson can use the videodisks to catch up on the lessons they missed (from "Videodisk" video). There is also a science software library that contains many programs closely aligned with the science curriculum. Individual students can get opportunities to use programs "to reinforce ideas or practice with concepts".

Instructional Television Videotapes (ITV) - Students may be assigned certain instructional videos for homework.

- Exploratory

LOGO - Students use LOGO to create shapes on the computer and to explore information regarding geometric concepts. In a fifth-grade class they construct machines from Lego pieces and perform LegoLOGO activities. They also use LOGO Writer.

Computer Probeware - This involves attaching a variety of different probes to computer equipment in order to conduct experiments or to collect data. Students use Probeware in science to collect data on light, heat, sound, and movement, and can then explore the information they collected through different representations such as graphs, tables, etc. (from "Computer Peripherals" video). Probeware activities were not observed, but they were mentioned in interviews.

Computer Simulations - "Simulations used in science class allow students a chance to test theories in a safe and controlled environment. They can apply their learning in a real life setting, making decisions, and watching the results and effects these have." Students work in small groups or watch as the teacher performs a demonstration for the whole class.

- Communication

Modems - Through the use of modems, students can gain access to on-line scientists and can talk to other schools about their findings. For example, a recent fourth-grade class participated in a National Geographic Kids Network Acid Rain unit. One of the schools in their group was from Japan. Students were eager to ask questions about the Japanese students' school day and leisure activities as well as about rainfall and ecology in their country.

- Tool

HyperStudio - 5th graders were using HyperStudio to illustrate stories they had written about themselves. On each card of their story, they were instructed to include a captured still image, a sound, text they had written, and a picture they had drawn. We also observed an after-school MultiMedia Club in which students were learning to use HyperStudio.

Video - 4th and 5th graders use video equipment in a number of ways. In some instances, taping and then viewing video reports helps children evaluate their own work. Students often tape special events or guest speakers. These can be analyzed by a class later. Students also create their own videotapes to enhance their class projects. For example, video club members videotape the skits that students in one fifth-grade class design and present to illustrate the meaning of their vocabulary words. A sixth grade class developed a video report about ecosystems and exchanged it for a video produced by a class in Brazil.

Word Processing - All grades (except 4th grade) are using word processors for writing.

Databases - *"Databases offer many opportunities to teach both content and process in the science curriculum. One method to accomplish this is having students develop their own databases as a means of focusing on collecting and organizing data."* We did not observe database activities.

4.2 Teacher Uses [*tchuse*].

- Communication

Telephones - Each classroom has a telephone-intercom system so that teachers can call each other. The technology coordinator also had access to a phone with an outside line so she can communicate with people outside the school.

Telecommunications - Modems are listed as a possible activity for teachers to communicate with colleagues or experts. However, we did not observe any teachers using modems.

Tool

Many of the teachers' uses of technology at Bay Vista are essentially tool uses.

- **Newspapers** are created at various grades to enhance communication among parents, teachers, and students.

- **Video camcorders** are utilized to create 'how to' videos and to record special events (e.g., Kindergarten Thanksgiving Pow-Pow, 5th grade VTV, Video club cable partnership) that are sent home and shared with parents.

- Students and teachers are creating flyers that are sent home in **Hip Pocket mail** (e.g. special events, Polaroid proof of purchase, school-wide activities).
- Student-generated projects are duplicated to be shared with other students and parents (e.g., Mammals and Man multimedia project)."

- Presentation

Videodisc - Many of the teachers used videodisks to present their lessons by referring to the still pictures or movies on the videodisks. Lecture/recitation is the type of pedagogy most often used. (These activities are usually followed by hands-on activities where students can explore materials in groups. However, the technology was not used by the students for this exploration.)

Overhead Projection Devices - Teachers also used projection devices so that all students in the class could see the object being displayed without having to crowd around the object. Objects range from work students have done to computer simulations to micro-organisms in petri dishes.

Instructional Television Videotapes (ITV) - Teachers use a variety of different videos for lecture/recitation purposes. Like the videodisc technology, these activities are usually followed by hands-on activities where students can explore materials in groups. It is not clear whether students sometimes use the technology for the hands-on follow-up activities (we did not observe them doing so).

Computer Probeware - This involves attaching a variety of different probes to computer equipment in order to conduct experiments or to collect data. Teachers use Probeware in science to demonstrate to students how to collect data on light, heat, sound, and movement.

Computer Simulations - Teachers can use technology to present a demonstration of their actions (including use of a computer program) or some small object to the entire class. In these instances, computers are connected to overhead projection screens or large television monitors so that the entire class can see better.

- Instructional Management

The following two excerpts are from document entitled "Model Technology Schools Self-Study."

"Computer technology has proven to be a productive tool for storing and retrieving information. Word processing, databases and spreadsheets as well as desktop publishing software are routinely used for:

- *Monitoring student attendance,*
- *Recording student records,*
- *Inventory of instructional equipment, materials, print media and other resources,*
- *Publication of newsletters, flyers and calendar,*
- *Developing site-based plans (i.e., technology and school improvement plans), and*
- *Generating reports for the school, district, and state."*

"2. Technology uses for classroom management

Teachers at [Bay Vista] enhance and expand the instructional program with a variety of technological applications:

- ***Teachers are designing activities** with software applications which combine text and graphics (e.g., integrated science lessons).*
- ***Databases** are used to catalogue instructional resources, schedule staff development activities, chronicle special events, and record the results of teacher and student surveys.*
- *Teachers are using **gradebook programs** to record students' progress."*

5.0 Implementation Details

5.1 Problems Encountered [*probs*].

- Difficulties in selecting hardware/software [***pick***]

  Rapid changes in technology make selection a never-ending issue. The State Software Clearinghouse is useful as a guide to good programs.

- Difficulties obtaining hardware/software [***get***]

  The school feels the need for additional hardware and software in order to support better integration into classes. They report that signing up and waiting for one's turn to use computers undermines spontaneity. Rapid obsolescence of technology is discouraging.

- Difficulties maintaining systems [***work***]

  None cited. Bay Vista has done remarkably well without an in-house technology person per se. This appears to have happened because a number of regular classroom teachers were unusually adept at computer maintenance (two received Apple Level I maintenance licenses) and because the district offered a responsive repair service for more severe cases.

- Theft/vandalism [***crime***]

  Internal theft has not been a problem. B. E. reported that there has been only one theft since 1980. Rooms are locked to deter entrance of outsiders.

- Teacher lack of knowledge/fear [***block***]

  Not a major factor.

- Lack of time for learning to use technology or developing technology-related curriculum units [***notime***]

  Overcome.

- Disappointing results from using technology [***letdown***]

  Not applicable.

- Poor alignment of technology w/ instructional goals [***mismatch***]

  Not a problem. Bay Vista has gone to considerable effort to obtain software and multimedia materials compatible with the state science curriculum framework. Perhaps because the state is such a large market, such software and materials have been developed.

- Lack of funds [***nofunds***]

  Overcome, at least so far.

- Resentment from nonparticipating classes/schools [***green***]

  Not cited by school staff. In answer to our direct question, a former district official said that there had been some jealousy on the part of other schools, but that the district took pains to set up grants and activities in such a way that other schools profited (e.g., Bay Vista teachers proficient in instructional uses of technology would visit other schools to do demonstrations and teachers from other schools are supported to visit Bay Vista). The Computer Cadre was designed so that there would be at least one teacher from each district school with lots of exposure to the Bay Vista computer-using teachers.

- Lack of technical support [***nohack***]

  Not a problem.

- Failure to see fast positive effects on test scores **[*noshow*]**

  Not a problem.

- Other **[*bug*]**

  The main barrier cited was a lack of space and the physical infrastructure for technology (e.g., insufficient wiring). Crowded classrooms make it difficult to move the computers in and out (desks have to be rearranged) and mean that many hands-on science activities are scheduled in a separate room for that purpose. This causes some disruption as equipment or students are moved from place to place.

5.2 Strategies for Overcoming Barriers [*solve*]

- Inservice training/release time

  Grant support has provided for coordinator positions which have given the school a degree of freedom in allowing teachers to view other classrooms (at Bay Vista or outside) with the technology coordinator taking over a teacher's class. In addition to the funding, the unusual degree of coherence in terms of curriculum and instructional approach at Bay Vista make this strategy work. There has also been support for teachers to attend in-service workshops and summer institutes. Technology is also demonstrated at faculty meetings.

- Involvement of outside experts

  J. K. (formerly of the district office) was influential in shaping the staff's thinking about the use of technology. The MTS Self Study also cites use of "a science consultant", but the consultant was not mentioned in the interviews.

- Creative fund raising

  With support from the district, the staff have been aggressive and successful in going after state grants. Several of the schools' teachers have given workshops for teachers from other schools on how to write successful grant applications.

- Other

  The major barriers of space and access have been addressed by putting the "higher-end" Mac/Apple computers on rolling carts and developing a schedule for them to go from class to class. In this way, teachers can have a critical mass of computers in their regular classrooms for scheduled times. (There is also a lab of IBM computers available). A team of students is assigned to each computer cart, and they are responsible for moving it from class to class on schedule. The same students stay with a computer over an extended period of time and are held responsible for its safety. Students take the responsibility seriously, and there have been only two serious accidents with the equipment since 1980.

5.3 Facilitators [facil]. *Describe factors that helped this project, including:*

- Technical support on hardware/software ***[techta]***
  At this school a core of teachers took it upon themselves to become knowledgeable about computers and their instructional applications. The presence of knowledgeable colleagues was cited as the antidote for teachers' concerns about technology.

- Teaching skills (nontechnology) ***[haveskl]***
  A 1984 report describes all the classrooms as arranged in traditional rows. My impression is that TOPS has led to more use of collaborative learning, small group work, and hands-on activities, and that the teachers have acquired skills in these areas through project-related activities.

- Technical assistance on integrating technology into instruction ***[instrta]***
  Through opportunities to observe each other, the school's Technology Committee (which meets monthly at 7 AM), inservice training, and faculty meetings, the teachers have helped each other learn about how technology can be used in their classrooms. We observed the Project Coordinator, for example, giving a technology-supported hands-on science lesson for the class of a relatively new second-grade teacher who did not feel comfortable doing this kind of lesson herself. The regular teacher was in the room observing the hands-on lesson and facilitating student groups (it was helpful to have two teachers).

- Supported time for teachers to develop skills ***[timesupp]***

Teachers are supported in attending in-service training and summer institutes and conferences. Most of the Bay Vista principals have put a strong emphasis on such activities as has the district.

- Other

5.4 Costs *[costs]* *(Estimates in dollars or person months)*

Between 1987 and September 1993, the estimated cost of the TOPS project was $737,498 with $535,212 supported by the state grant, $85,676 in matching funds, and $116,610 in donations. Expenditures for TOPS were $394,761 for project staff salaries and staff time for product development, $40,540 for clerical assistance, $42,230 for instructional materials, $66,012 for conferences and workshops, $163,011 for capital outlays, and $30,944 for training.

Other technology-related funding included $60K for the CompuTHINK project.

6.0 Impacts *[Impact]*

6.1 Effects on Students *[kidout]*. *Include areas such as:*

- Achievement

Yes. The MTS Self-Study notes improved achievement in science content as measured by the Comprehensive Tests of Basic Skills (CTBS) science subtests. During the 1987-88 school year, students scores rose an average of 1.3 school years compared to an expected .7 year for grade 3 and 1.0 year for grades 4-6. In addition, the Tests of Basic Process Skills in Science (BAPS), a 36-item multiple-choice test designed to measure skills in observation, inference, prediction, measurement, communication, and classification, was administered as a pretest in September 1988 and as a post-test in May 1989 to 71 sixth graders. Sixth graders showed improvements of 8.3%, 5%, and 5% respectively in observation, measurement, and inference skills. Scores for classification, communication, and prediction rose by more modest increments (3.3%, 1.7%, and 1.7%). Teachers felt that the pattern of increases was consistent with the process skills emphasized in their process activities and would have appeared even larger if the test had not placed such a heavy demand on reading skills. The MTS Self Study concluded that "Teachers report that students made substantial progress in understanding and applying science concepts". The principal states that technology has had a particularly strong impact on those with motor disabilities, limited English, or poor writing skills.

- Motivation ***[motiv]***
  Yes. Nearly all sixth graders completed science projects in 1988-89. Although no students had previously been involved in the county science fair, 13 entered in 1988-89 and 9 received awards. Student surveys showed that over 65% of students thought that technology had improved skills such as problem solving, writing, and reading. A majority also said that the use of technology had led to higher grades, more enjoyment of classes, improved ability to work with others. Teachers reported that students appear to take more responsibility for their own learning.

  The following is from document

  Data from surveys, questionnaires and interviews with staff and parents indicated that the project helped students develop skills and confidence using a variety of technologies including computers, video cameras, video disks and robotics ... The many hands-on activities (e.g., Science Circus, Monthly Calendar), Science Fairs and other contests (e.g., Egg Drop, Feature Creature), and special events (e.g. Technology Fair, Invention Convention) created interest in science and motivated concept development.

  School records showed increased student participation in science activities. In the second year of the developmental phase, nearly all students in grades 5-6 completed science projects. Thirteen Bay Vista students entered the County Science Fair and, of those, nine received science awards. This is especially noteworthy because in previous years no students had participated at the county level. Students were enthusiastic participants in all school-wide science activities. For example, over 150 students were involved in the acorn planing project.

- Self esteem ***[kidestm]***
  Yes. A majority of students surveyed reported that the use of technology had increased their self esteem.

- Attendance, retention, disciplinary rates ***[kidbehav]***
  No impact of technology reported.

- Technology skills ***[hackskl]***

  Yes. A district survey administered to junior high students in 1991-92 showed that former Bay Vista students had a greater appreciation of the uses of technology and felt more comfortable using technology than did students from other feeder schools. The MTS Self Study reported that students developed skills and confidence using technologies such as computers, videocameras, robotics, and video disks. We observed students using the first two of these with ease, including the use of multimedia software to design their own presentations.

6.2 Effects on Teachers [*tchout*]. *Include areas such as:*

- Inclination to assign complex tasks ***[hardtask]***

  Yes. Teachers report more focus on conceptual issues within science. Technology supports teaching a problem solving curriculum in the upper elementary grades.

- New instructional strategies ***[tchstrat]***

  Yes. The MTS Self Study reports that teachers moved "from dispensing information to facilitating interactions among students and between students and natural phenomena". Teachers reported doing more activity-based science. Logs of project activities indicate that all teachers increased their use of technology; over 80% use the computer/hands-on science lab on a regular basis; 70% schedule the mobile computers regularly.

- Self esteem and sense of professionalism ***[tchach]***

  Yes. Teachers report feeling more comfortable about using technology. Many felt that their presentation skills had increased. Teachers have been active in district, county, and regional educational technology activities. One teacher became a Christa McAuliffe Educator in 1988.

- Communication with other teachers ***[tchtalk]***

  Yes. Teachers report that TOPS increased communication and collaboration among teachers. Even before TOPS, technology-related activities were bringing Bay Vista teachers into activities with each other and with teachers from other schools (e.g., teaching grant writing, demonstrating teaching with technology, reviewing software). The activity of grant-writing was cited as important for bringing teachers together and leading them to develop their ideas.

- Use of their time *[timeuse]*

  Yes. Neither the Self Study nor the interviews addressed the issue of how teacher time is allocated. It was noted in the observations that setting up for either technology or hands-on activities consumes some time, but that students are highly engaged in the activities and there is less teacher lecturing. The project has also increased the opportunities for teachers to obtain release time and view each other's teaching.

6.3 Effects on School Climate & Processes [*schoul*]

- Increased linkages with outside organizations, resources *[link]*

  Yes. The TOPS program has led to recognition for Bay Vista within the district and state. The district notes that this school is ahead of the district's high schools in the integration of technology. Bay Vista teachers are active in CUE and in reviewing instructional software for the state's Software Clearinghouse, IBM, and the Learning Company. Teachers have offered workshops for pre-service teachers at sites within the state university system, participated in the state's Educational Technology Summit to develop a state-wide technology plan, presented at the Science Framework Interpretation Conference, and provided student pictures for the local PBS channel (for which the project coordinator serves on the Board of Directors).

- Enhanced role as magnet *[magnet]*

  Yes. Although the school is full and is not accepting students from elsewhere in the district, it is regarded as a desirable school to attend. Teachers are attracted here as well, as evidenced by the fact that the upper elementary teachers at Bay Vista chose to stay when the district initiated middle schools.

- Recognition

  Yes. The school was cited as a model in the State Department of Education's Elementary Grades Task Force Report. The school receives visitors from around the world. School and project staff have published articles in several well-known local educational periodicals. Teachers have been the subject for interviews and reports for national publications including

Newsweek, New York Times, Business Week, Media and Methods, Teaching and Computers, and *Computer Learning.* Project leaders have presented at conferences including CUE, ACSA, ESSA, CSTA, NEA, Early Childhood Education, and Chapter 2.

6.4 External Accountability Measures & Their Influence [*account*]

Like other Level II MTS projects, TOPS had to demonstrate its alignment with the state curriculum framework (and hence associated accountability measures) as a condition for funding. TOPS developed instructional strategies and materials congruent with the state's recently adopted Learning Assessment System (LAS).

6.5 Evaluation [*eval*]

- Test scores

  Yes. The MTS Self-Study notes improved achievement in science content as measured by the Comprehensive Tests of Basic Skills (CTBS) science subtests. During the 1987-88 school year, students scores rose an average of 1.3 school years compared to an expected .7 year for grade 3 and 1.0 year for grades 4-6. In addition, the Tests of Basic Process Skills in Science (BAPS), a 36-item multiple-choice test designed to measure skills in observation, inference, prediction, measurement, communication, and classification, was administered as a pretest in September 1988 and as a post-test in May 1989 to 71 sixth graders. Sixth graders showed improvements of 8.3%, 5%, and 5% respectively in observation, measurement, and inference skills. Scores for classification, communication, and prediction rose by more modest increments (3.3%, 1.7%, and 1.7%). Teachers felt that the pattern of increases was consistent with the process skills emphasized in their process activities and would have appeared even larger if the test had not placed such a heavy demand on reading skills. The MTS Self Study concluded that "Teachers report that students made substantial progress in understanding and applying science concepts". The principal states that technology has had a particularly strong impact on those with motor disabilities, limited English, or poor writing skills.

- Retention rates

  No data available.

- Attendance
  Above district average.

- Discipline rates
  Suspension rate below district average.

- Teacher turnover
  Teacher turnover is low and mostly attributable to causes such as retirement and pregnancy.

- Other
  The May 1992 Program Quality Review was quoted in the MTS Self Study with the following Recognition of Program Strengths:
  [Bay Vista School] has made an impressive effort in the area of science through the use of technology and hands-on activities. The Science leadership is exemplary and is on the cutting edge in the state. The curriculum is student centered and in alignment with the current state framework. Teacher committees are developing lessons integrating technologies as tools for teachers to facilitate lessons using cooperative learning strategies to give all students access to the science curriculum....The collaborative teaching process is integrated throughout the curriculum. This is an excellent institutionalized program that has been sustained. It is a model for all curricular areas.

7.0 Reflection and Advice

7.1 Dissemination [*spread*]

Over 55 schools have received state grants to adopt or adapt Project TOPS. Bay Vista teachers are active in state associations and committees and publish in venues that other teachers read. School and project staff have published articles in several well-known local educational periodicals. Teachers have been the subject for interviews and reports for national publications including *Newsweek, New York Times, Business Week, Media and Methods, Teaching and Computers,* and *Computer Learning.* Project leaders have presented at conferences including CUE, ACSA, ESSA, CSTA, NEA, Early Childhood Education, and Chapter 2. J. K. reports that he brought many of the ideas that had worked successfully at Bay Vista to another nearby urban city Level I Model Technology Schools project.

7.2 Plans [*plans*]

The staff are trying to prepare themselves for the conclusion of their demonstration grant. They expect to curtail a number of their dissemination activities, but believe that the critical mass of technology using teachers has been reached such that it will continue.

7.3 Advice [*advice*]

The Project Coordinators offer a number of pieces of advice:

- Value teachers' input and allow time for teachers to grow.
- Be prepared for growth to be slow and reward small improvements.
- Encourage collaboration.
- Think of staff development as an ongoing process; build networks that reinforce each other.

J. K. offered some additional lessons from the Bay Vista experience:

- Districts and states can use school-based grants programs as a mechanism to stimulate creativity and thinking among teachers.
- Orchestrate intrinsic rewards such as providing opportunities for teachers to get to places they couldn't have gotten before (e.g., testifying before the state legislature) where they can describe what they do in the classroom.
- Bring in the rest of the district, politicians, and the community to see what the school is doing and appreciate it as a resource (e.g., a local state assemblyman nominated L. M. as a Christie McAuliffe educator).
- Use teachers as peer coaches for other teachers.
- Innovating schools need strong leadership from a principal who will award teachers for experimenting.
- Teachers need individualized staff development (e.g., the opportunity to observe another teacher doing something they are trying to do) rather than canned workshops.
- Work with the bargaining unit so that they will not regard project activities as inequable or cause for grievance.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: 4th/5th Grade Video Club

Teacher: R.S.

Site: Bay Vista Elementary School

1.0 Summary [*sum*]

Fourth and fifth graders use video equipment (VHS, video cameras, tripods, VCR's, and TV's) in a number of ways. In some instances, taping and then viewing video reports helps children evaluate their own work. Students often tape special events or guest speakers. These can be analyzed by a class later. For example, students video taped a guest lecture by a NASA scientist who came to their school. At the video club meeting after school that day, the teacher reviewed the video with the students, discussed filming techniques and evaluated the students' filming.

Video Club activities are integrated with other school activities. For example, video club members were asked to video tape word definition skits in B. E.'s fifth grade classroom. Students also create their own videotapes to enhance their class projects. Students write scripts, do filming, etc. The subject matter varies according to the subject being videotaped. Students use computer equipment to produce the titles for their videos. The Video Club has also produced tapes of school activities for sale to parents.

2.0 Classroom Context [*context*]

The classroom used for Video Club activities is actually a room used for all sorts of other events as well. There are a number of chairs and tables in the room which are often rearranged, depending on the type of activity going on. There is a television set on a rolling cart and 2 VCR's (for editing purposes) in the classroom, as well as several cabinets where they store their video tapes. However, this is not the permanent home for the Video Club - each year they tend to move where ever there is space for them at the school.

The Video Club consists of 9 to 11, fifth grade students, and the activities this group performs are completely integrated within the school. Video Club students are often pulled out of their regular classes to videotape different types of events, school-wide or otherwise. The students also meet after school to evaluate any taping they did that day, to work on video projects (such as editing videos they have shot), to learn video taping and editing techniques, or to write scripts for videos they are creating.

The instructor is actually the school's speech therapist who also moderates this club. She started the Video Club in 1988 after having produced school videotapes on the TOPS science program - she said she got into it "through the back door" and felt the students were technically competent enough to learn how to operate the cameras.

3.0 Reform Features *[feature]* *(Classification of reform features illustrated.)*

X Interdisciplinary	X Project-based	X Collaborative Learning	Mixed Age
X Extended Activity	X Part of Core Program	X Teacher as Coach	

4.0 Description of Activity *[activity]*

Video Club participants are students the teachers feel could benefit from participating in the club. Specifically, teachers choose students who are able to stay after school and who need to work on their creativity, cooperation skills, self-esteem, and their sense of responsibility. Because these students are often pulled out of their regular classes to videotape different types of events (school-wide or otherwise), they must first have finished their work in those classes.

There are no specific subject areas involved in this activity. In a sense one could say ALL subject areas are involved because students cover any type of event that is going on in their school, from guest speakers to the science fair to their field trips. They also create their own videos to supplement class projects they are working on.

In the club, students learn how to operate video cameras and tripods, and how to care for the equipment. They work together in small groups and take turns using one of 2 video cameras to tape events. At the NASA Assembly we observed, both cameras were being used by students who were working in pairs to tape the event. At the end of the assembly, they carefully placed the cameras back into their cases before leaving the auditorium.

After they have videotaped an event, students come together after school to watch the video tapes they shot that day and to critique their work. The club advisor facilitates this discussion and instructs them to be critical of their own work and not the work of their classmates - this helps de-emphasizes the name-calling or "pointing fingers" that can take place and focuses attention on improving their own performances. The teacher uses the 2 VCR's and the TV to show the students the work they have done with the filming. The students also meet after school to work on video projects (such as editing videos they have shot), to learn video taping and editing techniques, to write scripts for videos they are creating, or to set up computer equipment to produce subtitles for their videos. The club meets after school on Tuesdays and Thursdays from 2-3 PM. (School ends at 2:30.)

5.0 Technologies Involved [*types*]: *Check off technologies used.*

X • Microcomputers
- ILS
- Other LANs
- WANs
- CD-ROM
- Interactive videodisc

X • Videocams and editing equipment
- Word processing
- Spreadsheet
- Hypermedia
- Animation
- Simulation
- Other

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses **[*kiduse*]**

Tutorial ***[tutor]***
No evidence of this.

Exploratory ***[explore]***
No evidence of this.

Communication ***[commtn]***
No evidence of this.

Tool ***[tool]***
Students use *video cameras* to film activities that are taking place throughout the school or to create their own videos for other class projects. They also use *VCRs* to edit their videos. Students use *computers* to create the subtitles for the videos they produce.

- Teacher Uses **[*tchuse*]**

  Communication
  No evidence of this.

  Presentation
  The use of technology in the club is primarily by students, but the teacher facilitates a discussion using 2 VCR's and a TV to show the students the work they have done with the filming. She instructs the children to be critical of their own work and not the work of their classmates.

  Instructional Management
  No evidence of this.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration

  Yes. Because there are only 2 video cameras, students must learn to work together on video projects. Video Club participants are students the teachers feel could benefit from participating in the club, especially those who need to work on their cooperation skills, among other things.

  The production team consists of a producer/director who oversees the entire project, a camera person who operates and takes care of all video equipment, and a production assistant who takes care of anything that comes up during production. The final production team consists of script writers, production editors, and computer mavens and artists who create titles and graphics. (from document entitled "Video Workshop" Creating Videos in the Classroom") The assignment of these disparate duties clearly indicate the importance of collaborative work among students.

- Independent exploration

No concrete evidence of this, although students are encouraged to act in their own videos to help them with their speaking skills.

- Access to outside information resources

  Yes. The teacher takes students on field trips to local TV stations so they can see video professionals at work. A local cable TV company donated time and materials, aired TOPS activities to the community, and helped the school staff and students produce videotapes.

- Support for higher-level thinking

  I found no concrete evidence (written nor through interviews) that this was an explicit goal, but the children's having to come up with their own story line through script writing does require higher-order thinking skills.

- Creativity

  Yes. In the Video Club application, students are asked whether or not they are good at creative writing, art, or coming up with good ideas. Teachers also select students they feel could benefit from participating in the club, especially those who need to work on their creativity, among other things.

- Technology skills

  Yes. Students are taught to use a video camera and tripod, to edit video tapes, and to use computers to create titles.

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***

  Yes. The teacher stated that each year more students who want to join the Video Club apply than she can accept, which shows how eager students are to join the club. (She only accepts 9-11 students each year.) She also mentioned that students' self-esteem increases as they learn to work with the equipment and as they see the results of their work.

  Another indicator of motivation is the fact that kids must finish their regular class work before they are permitted to leave that class to go videotape an event during school time. The club advisor reports that this rule motivates them to finish their regular school work in order to participate in Video Club activities.

The ability to take the videos they produced home to show their parents is also another motivating aspect of this activity. Having access to the tapes to show to their parents motivates students to do a better job on the video because they know their parents will be seeing it. Creating productions for cable TV also have this same motivating effect - knowing others will see their videos motivates them to do their best.

- Attendance, time on task, discipline ***[kidbehav]***
  Yes. The day we were observing the students videotape the NASA assembly and then meet for a debriefing session on how the video taping sessions went, I saw no evidence of any discipline problems. Students were given full responsibility for the equipment (setting it up and putting it away) and for being in the right place at the right time. They were very attentive to the instructor and were very interested in the discussion that was taking place. They seemed to be very focused and on-task the entire time we were observing them.

- Amount of collaboration & cooperative learning skills ***[cooplg]***
  Yes. Students do learn how to work together cooperatively in groups to accomplish their goals of videotaping events or creating videos. When I observed students videotaping the NASA Assembly, I saw them working together very cooperatively—two pairs of students were taking turns videotaping the presentation and they also worked together to put the equipment away when the assembly was over.

The assignment of students to specific roles within production teams also strengthens their collaboration skills. The production team consists of a producer/director who oversees the entire project, a camera person who operates and takes care of all video equipment, and a production assistant who takes care of anything that comes up during production. The final production team consists of script writers, production editors, and computer users and artists who create titles and graphics.

In a description of student survey results in a document entitled "Model Technology Schools Self-Study, Nov., 1993, the authors state that *"Students also reported improvement in their ability to work with others, their attitudes toward school and their self-esteem (e.g. Video Club)"*.

- Ability to manage own learning ***[selfreg]***

  Yes. After they have videotaped an event, students come together after school to watch the video tapes they shot that day and to critique their work. The teacher facilitates a discussion and instructs them to be critical of their own work and not the work of their classmates. She feels that this helps de-emphasize name-calling or "pointing fingers" focuses students' attention on improving their own performances. The teacher also helps them realize what they individually did wrong and how they could improve their performance the next time they use the equipment. In their Model Technology Schools Self-Study, the authors concluded that *"Students seemed to gain more control and to take more responsibility for their own learning."*

- Access to outside information resources ***[outInfo]***

  Yes. The process of videotaping the guest speakers that come to their school is in itself a demonstration of how they have access to outside information resources. They also have access to outside information resources when they go on field trips to visit local television stations.

- Support for higher-level thinking ***[higher]***

  Yes. Students show this skill through their productions. A great deal of higher-order thinking is needed and is evidenced through the videos that the students actually produce for themselves. Not only must they learn how to write a script, but they must also learn how to convey their ideas through video and how to arrange the scenes to tell a story as well as deciding which scenes to keep and which not to include in order to get their story across.

- Complexity of task students can accomplish ***[taskacc]***

  Yes. The Video Club participates in activities that range in complexity depending on what it is they are doing. The process of creating a videotape from scratch is in and of itself a complex task that involves writing a script, coming up with a set or location for filming, making sure the lighting is appropriate, deciding who will narrate the video or if there will be actors, choosing the actors and/or acting in the video, editing the tape with the editing equipment, designing and creating titles for the video as well as any music or sound that will accompany the video, etc. On the other hand, simply videotaping an event such as the NASA presentation is not a very complex task in and of itself.

- Learning on specific tasks ***[kidlearn]***

  Yes. As participants in the Video Club, students actually do the following:

  - use a video camera (from how to turn it on and set it up on the tripod to learning how to focus, zoom, pan, etc.)
  - write a script
  - edit videos
  - make at least one 2 minute movie
  - videotape for teachers and school projects
  - create productions for cable TV
  - use a computer to create titles
  - visit a TV station

  (This list of items taken from the document entitled "Video Worskhop Creating Videos in the Classroom.")

  In addition to these skills, students also learn how to work in a team, collaborating with their peers. They learn to take responsibility for the equipment they use. As others see the work they have done, they experience an increase in their self-esteem, and they are also able to improve their creativity.

- Creativity ***[create]***

  Yes. The process of creating a videotape from scratch is in and of itself a complex task that involves writing a script, coming up with a set or location for filming, making sure the lighting is appropriate, deciding who will narrate the video or if there will be actors, choosing the actors and/or acting in the video, editing the tape with the editing equipment, designing and creating titles for the video as well as any music or sound that will accompany the video, etc. All of these tasks require some degree of imagination and creativity.

- Greater attention to how a product will be understood by others ***[audience]***

  Yes. Students in the Video Club understand that the products they create will be viewed by others. Having access to the tapes to show to their parents motivates students to do a better job on the video because they know their parents will be seeing it. Creating productions for cable TV also has this same effect - knowing others will see their videos motivates them to do their best.

- Technology skills ***[hackskl]***

  Yes. Students who participate in the Video Club learn

  - how to use a video camera (i.e. how to turn it on and set it up on the tripod to learning how to focus, zoom, pan, etc.),
  - how to use a tripod (i.e. how to attach the camera to the tripod securely, how to set-up the tripod so that it is level when they go to pan a scene, etc.),
  - how to edit videotapes
  - how to use computers to create titles for their videos.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: 3rd Grade Micro/Macro Video Learning System

Teacher: S. T.

Site: Bay Vista Elementary School

1.0 Summary [*sum*]

The way in which S. T. uses technology with her 3rd graders is a very typical use of technology for this school. S. T. introduces her class to a topic by asking them questions in a whole class discussion (lecture/recitation format). She uses the blackboard to write down key concepts and also uses a laser disk and a Micro/Macro Video System hooked up to a large monitor to illustrate key concepts she wants to convey to her class. The day we observed her, she was conducting a science lesson on decay. After the laser disk and Micro/Macro lesson, she arranged for students to do hands-on exploration of the same topic in small groups; later students shared their drawn images using the Micro/Macro projection system.

2.0 Classroom Context [*context*]

The students' desks are lined up in rows facing the front of the classroom, where there is a blackboard, the teacher's desk, a rolling cart with a TV, VCR, and laser disk, and a table with the Micro/Macro Video Systems technology on it.

The first day we observed her, S. T. introduced her class to the topic of decay by asking them questions in a whole-class discussion format. Throughout the discussion, she used the blackboard to write down key concepts and than reinforced these ideas with images and video clips from the laser disk, which was attached to a large monitor that the entire class could see. After she completed the portion of her lesson with the laser disk player, she attached the Micro/Macro device to the large monitor, enabling students to look at micro-organisms on a petri dish. They continued their discussion on these organisms until the end of the class period.

Two days later, S. T. arranged for her students to do hands-on exploration of the organisms in sealed petri dishes which she had shown them in the previous class. In addition to S. T., L. M. (the Technology Coordinator) was also present to help with this lesson, which took place in the school's hands-on project room.

S. T. obtained her teaching credential in 1987 and has been teaching in the city's Unified School District since that time. During her time as a substitute teacher in this district, she was attracted to Bay Vista because the "teachers were welcoming" and because of the general atmosphere. "The teachers are willing to share." While substituting at Bay Vista, she got to know L. M., the Technology Coordinator, and also got to know more about the TOPS (Technology Optimizes Performances in Science) program. She ended up job-sharing with L. M. for 2 years, she taught 6th graders for one year full-time, and is now in her 2nd year of teaching 3rd graders full-time. When she first came to Bay Vista to teach, she "felt uncomfortable with computers" and says she "is still not totally comfortable with computers," although she shows no hesitation when using laser disk players, microscopes attached to the computer, and other overhead projection devices.

In fact, what was particularly striking when observing S. T. teach in her classroom was the way she handled transitions between viewing the laser disk and viewing with the Micro/Macro equipment. During her whole class discussion on decay, she began with the laser disk technology and then needed to switch to using the Micro/Macro equipment which involved going behind the TV/laser disk unit to unplug the laser disk player and plug in the Micro/Macro video equipment. Rather than completely stop the class discussion while changing the equipment, she continued to lead the discussion and was able to hold the students' attention at the same time that she was making the transition from one technology to another. This is not an easy task, but she pulled it off beautifully!

3.0 Reform Features *[feature]* *(Classification of reform features illustrated.)*

Interdisciplinary   X Project-based   X Collaborative Learning   Mixed Age
Extended Activity   X Part of Core Program   X Teacher as Coach

4.0 Description of Activity *[activity]*

The first day we observed her, S. T. introduced her class to the topic of decay by asking them questions in a whole-class discussion format. She had her students clear their desks of everything but their blank paper and pencils and encouraged them to take notes during the discussion. Most of the children did not appear to be taking notes during the class session, but they were very attentive during the large-group discussion. Throughout the period, S. T. used the blackboard to write down key concepts and then reinforced these ideas with images and video clips from the laser disk, which was attached to a large monitor that the entire class could see.

S. T. asked the class questions about decay and then used time-lapsed photographic images from the videodisk to illustrate the process. The most graphic portion of the videodisk showed a close-up of a dead rat lying in a field. The rat's body swelled and then exploded, showing many tiny organisms eating away at the carcass, which eventually disintegrated. Before showing this to the class, S. T. made sure to prepare them by warning them that it would be a bit gory. (I can't remember what words she used, but I do remember that she didn't use the word "gross".) This seemed to help prepare them so they would not get out of hand—they were able to watch the movie with remarkably little class disruption. She continued to show them other images of decay such as molding apples. S. T. made a strong effort to demonstrate that some forms of decay are associated with negative consequences (such as tooth decay), while others have a more positive effect (such as leaves falling, drying up, and turning into rich soil for plants).

After S. T. completed the portion of her lesson with the laser disk player, she attached the Micro/Macro device to the large monitor which enabled the entire class of students to look at microscopic organisms on a petri dish that was being magnified by the Micro/Macro video projection system. The class was able to see living bacteria which were collected from the classroom air molecules. The class continued their discussion on these organisms until the end of the class period.

S. T. has written about the advantages of the Micro/Macro technology:

1. *There is a feeling of excitement which comes from seeing living organisms which can't be duplicated by using laser disk or video images! Also, the unexpected life forms which may appear at any moment add surprise and mystery! There is always an element of wonder, curiosity and surprise at seeing life functions as they're happening.*
2. *All students are seeing the same things, so discussion and other whole class activities are more easily facilitated. Share the experience!*
3. *The teacher is able to focus and follow the movement of live organisms.*
4. *Fewer slides and living specimens need to be prepared than would be necessary for multiple stations.*
5. *It's possible to record micro-activities on the VCR as they occur.*

Two days later, S. T. arranged for her students to do a 50-minute hands-on exploration of the organisms in sealed petri dishes which she had shown them in the previous class. In addition to S. T., L. M. (the Technology Coordinator) was also present to help with this lesson, which took place in the hands-on project room. For this part of the lesson, students worked in small groups, but did not use the laser disk technology. Each group of students (4-5 students per group) was given one sealed petri dish, a magnifying lens, a flashlight, and a worksheet to fill out. The task was to draw the organisms on a piece of paper, discuss what they saw, and write down any details they thought were interesting about their micro-organism. Each group member had a role—e.g., the "getter" was the person who went to get materials for the group and was the only person in the group who could ask the teacher for help. Help could only be sought after the entire group discussed the issue and decided they still needed the teacher's help. The "recorder" was to record anything the group discussed, the "illustrator" drew a picture of the organisms in the petri dish, and the "reporter" was assigned to report the group's findings to the entire class. These roles for collaborative groups are used across classrooms and grade levels; thus, children are highly familiar with them and do not need to be given basic ground rules every time they begin a hands-on activity.

Because there were given only one sealed petri dish, one magnifying lens, and one flashlight, students really needed to take turns using these tools, which was a bit of a struggle for some students who wanted more time with the instruments. Overall, the students succeeded in collaborating to complete their worksheet and reported their findings with illustrations via Micro/Macro to the whole class during the last 5 minutes of the period.

5.0 Technologies Involved [*types*]: *Check off technologies used.*

X • Microcomputers

• ILS

• Other LANs

• WANs

• CD-ROM

X • Interactive videodisc

• Videocams and editing equipment

X • Other ------> Video learning system project device

- Word processing
- Spreadsheet
- Hypermedia
- Animation
- Simulation

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses **[*kiduse*]**

Tutorial ***[tutor]***

The videodisk and Micro/Macro overhead projection devices used for these activities were used for tutorial purposes--providing students with a demonstration of a concept. The technology was not used as a stand-alone tutorial, however; it was interwoven into the teacher's lecture and teacher-led discussion, reinforcing points and stimulating questions.

Exploratory ***[explore]***

Students did not use any technology for exploratory purposes although the unit did include exploration of the contents of the petri dishes.

Communication ***[commtn]***

Not part of the observed activity. Previously, however, working with the city's State University master's candidate, S. T. pilot tested an international student video exchange program, "You, Your Community, and the Natural Environment". Students participated in hands-on ecological activities (such as a micro climate planter experiment and visits to the pond and marsh land) and produced a video report for exchange with a classroom in Brazil.

Tool ***[tool]***

In her interview, S. T. mentioned that she is using the Children's Writing and Publishing Center and Linkway (an IBM graphics program with text capabilities) to describe their science activities.

- Teacher Uses **[*tchuse*]**

Communication

Although students are using technology to exchange information with students in other schools, S. T. did not talk about communicating with teachers from other schools. She did mention getting plenty of support for the implementation process from other Bay Vista teachers and stated *"...all you need to do is pick up the phone... [B. E.] is always available, or her kids come and help."*

Presentation

Yes. The videodisk and Micro/Macro overhead projection devices were used for presentation purposes. The teacher used the technologies to teach a lesson by providing students with a demonstration of the concept of decay and with images of live bacteria. The information being presented to students came from the teacher as well as from the videodisk technology and the images displayed through the Micro/Macro overhead projection devices.

Instructional Management

Not observed.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration

  With the exception of sharing the group illustrations through the Micro/Macro video learning system, students did not use the technology for the collaborative learning activities. During their hands-on sessions, the students used magnifying lenses and flashlights to examine the contents of the petri dishes.

- Independent exploration

  Students did not use the technology for independent exploration in this particular lesson, but did have time for independent exploration during their hands-on sessions where they used magnifying lenses and flashlights to examine the contents of the petri dishes.

- Access to outside information resources

  No evidence of this as a learning goal or as an intended benefit although, in her interview, S. T. mentioned that they were able to trade information with other schools, but she did not indicate how this exchange of information took place—i.e., if there was some technology (besides the telephone) involved, or whether or not the students were involved in this exchange of information or if she simply traded the information and then shared the other school's findings with their class.

- Support for higher-level thinking

  Yes. *"...the Macro is also extremely useful for 'hands-on' demonstrations such as dissections, using modeling compounds, or for sharing & observing live, fragile or delicate things... These activities are helpful for development of close, accurate observational skills. They also help develop a sense of size and scale and may encourage the ability to compare and contrast. Perhaps they may contribute to a sense of wonder of the universe and a respect for life in all forms!"*

- Creativity

  S. T. reports that the Linkway illustrations of science concepts are designed to foster creativity in presentation.

- Technology skills

  No evidence of this. The teacher used the technology in the observed lesson.

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***

  Yes. In her interview, S. T. stated that the laser disk technology "makes a big difference" for her in teaching. "The kids are more interested in the active movement" that comes from the videodisks and from the Micro/Macro overhead projection devices. Students appeared highly attentive during S. T.'s presentation and participated actively in discussions.

- Attendance, time on task, discipline ***[kidbehav]***

  Yes. In her interview, S. T. stated that the laser disk technology "makes a big difference" for her in teaching. She believes that the kids are not only more interested in material presented on videodisks and with the Micro/Macro overhead projection devices but that it actually "helps the kids focus."

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  Students did not use technology in their collaborative hands-on work but did use it to present each group's illustration. The activity as a whole supported collaborative learning skills.

- Ability to manage own learning ***[selfreg]***

  In this lesson, the students were not using the technology for their own learning.

- Access to outside information resources ***[outinfo]***
  Not part of this lesson.

- Support for higher-level thinking ***[higher]***
  Yes. There was some evidence of this during the large-group discussion where the teacher was demonstrating the laser disk images and talking about decay. She asked them some questions which made them think about decay in ways they had not thought of before. S. T. made a strong effort to make the point that some forms of decay have a negative consequence (such as tooth decay), while others are beneficial (such as leaves falling, drying up, and turning into rich soil for plants). However, it's hard to say to what extent the technology itself was the factor that supported their higher-level thinking as opposed to the teacher's questions and comments.

- Complexity of task students can accomplish ***[taskacc]***
  Students were completing complex tasks, but were not using the technology to do so. (Each group of students--there were 4-5 students per group--was given one sealed petri dish, a magnifying lens, a flashlight, and a worksheet to fill out. The task was to draw the organisms on a piece of paper, discuss what they saw, and write down any details they thought were interesting about their micro-organism.) However, it could be argued that the technology had made possible their acquisition of concepts during the presentation that were then carried over into the activity.

- Learning on specific tasks ***[kidlearn]***
  The children were not learning to perform any specific tasks with the technology.

- Creativity ***[create]***
  No evidence that creativity was a goal of this particular lesson.

- Greater attention to how a product will be understood by others ***[audience]***
  Not applicable to this lesson.

- Technology skills ***[hackskl]***
  No evidence from this particular lesson since the students themselves were not using the technology.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: 5th Grade Multimedia Project

Teacher: R. B.

Site: Bay Vista Elementary School

1.0 Summary [*sum*]

Fifth-grade students in R. B.'s class were creating their own illustrated stories using HyperStudio software, a multimedia software tool that allows students to design a presentation combining text, graphics, and sound. Students were using Macintosh computers to construct their HyperStudio projects; they used word processing programs to write their stories, Macintosh computer sound input devices (microphones) to record their sounds, draw programs or HyperStudio to create graphics, and a Canon Xap Shot Still Video Camera attached to a Macintosh computer to import photographs. The subject matter in the observed activities was language arts. In a second phase of the project, students prepared multimedia science reports. Some of the students incorporated laser disc materials into their reports.

2.0 Classroom Context [*context*]

There are an average of 32 students in this classroom. On the days we visited, the instruction was organized so that approximately half of the students were working in small groups at computers located around the room's perimeter while the other half worked individually at their desks.

The classroom is located in a portable building, and like most other classrooms, has an arrangement of student desks in the middle of the room. The most striking feature of this classroom was the computer carts with wheels located along each of three walls of the classroom which hold Macintosh computers—there were 10 of them. After R. B.'s class was finished using the computers, the students rolled them out of the classroom and took them to the classroom that was next on the computer schedule. There is a team of 4 students assigned to each computer to ensure that the computer is transported securely from the portable classroom. There is also one student assigned as the "step monitor"; because the classroom entrance has two steps and is not level with the ground outdoors, the "step monitor" guides the teams of students down the steps. At the count of three, the students lift the desk and carry the computer safely to ground level and roll it away to the next classroom. This is an amazing sight, especially on rainy days where students cover the computers with large plastic tarps before exiting the building!

R. B. is the only teacher in this classroom. R. B. is a relatively new teacher, now in his third year of teaching after an earlier stint in a career in law. Unlike most teachers, R. B. (age 32) "grew up interested in computers". Early on he learned BASIC programming and acquired troubleshooting skills that he finds useful in the classroom.

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

Interdisciplinary X Project-based X Collaborative Learning Mixed Aged
X Extended Activity X Part of Core Program X Teacher as Coach

4.0 Description of Activity [*activity*]

Students in R. B.'s class were instructed to write a story and create a HyperStudio presentation of the story they had written. They were to create 5 "cards", with each card consisting of a background, text they had written and imported into HyperStudio, a button, a sound, a graphic, and a digitized still photograph. They were given two 45-minute sessions per week for 8 weeks to work on this project.

The days we observed the classroom, students were busy working on their projects and were in different stages of completing their projects. Some students were composing their stories at the computer using a word processing program. Others were taking photographs with the Canon Xap Shot Still Video Camera and saving the pictures onto floppy disks so they could later add the photo to their project. Other students were working at the computers creating their projects--they were in the process of recording their sounds, creating backgrounds and buttons, importing text and still photos, and deciding on color schemes for each card.

As students were busy working on these projects, R. B. was answering any questions students had, monitoring their progress, and giving them words of encouragement and praise.

R. B. feels that technology can be "the ultimate carrot" for students. It's something they want to master; learning to use it enhances their self-esteem and makes them excited about coming to school. He cites additional advantages in being able to tap into multiple intelligences; giving kids with diverse strengths a chance to excel. Finally, technology helps to prepare kids for jobs when they leave school. They gain both technology experience (including troubleshooting) and confidence. R. B. says, *"Nobody leaves my class a technophobe."*

5.0 Technologies Involved [***types***]: *Check off technologies used.*

X • Microcomputers
• ILS
• Other LANs
X • Word processing
• Spreadsheet
X • Hypermedia
• WANs
X • CD-ROM
X • Interactive videodisc
• Videocams and editing environment
• Animation
• Simulation
X • Other --------> Canon Xap Shot Still Video Camera

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses [***kiduse***]

Tutorial ***[tutor]***
No evidence of this.

Exploratory ***[explore]***
No evidence of this.

Communication ***[commtn]***
No evidence of this.

Tool ***[tool]***
R. B. emphasizes tool uses of technology in his class. The observed activity was consistent with the statements he made in his interview, ***"there is no reason adult software can't be brought in [to the classroom]."*** R. B. sees teaching students lots of technology tools and how to bring them together as an

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instructional goal. The observed project involved language arts writing, and he expected to then have students use the software in developing reports in other subjects. The HyperStudio project required students to use a number of different technology tools:

Word Processing - Students either composed their stories at the computer using a word processing program, or they first wrote their story by hand and then typed it into the computer.

Capturing Still Images - Students learned how to use a Canon Xap Shot Still Video Camera to digitize and save still photographs. They saved their pictures on floppy disks so they could later add them to their project.

Hypermedia - Students were using HyperStudio to create their hypermedia projects. They recorded sounds using the Macintosh built-in microphone, and then imported that sound by creating a button for it. They created backgrounds for each card and had to decide what color each card would be. They imported text they had written previously into each card using a text field, and also imported still photos they had taken.

- Teacher Uses **[*tchuse*]**
  Not applicable. In the observed lesson the students rather than the teacher were using the technology.

  Communication
  No evidence of this.

  Presentation
  No evidence of this.

  Instructional Management
  No evidence of this.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration
  For the most part, the observed project activities were conducted individually, except in the case of several students with limited English. Students did work in

small groups (2-3 students) when they were using the Xap Shot Still Video Camera. For the second phase of the project, the teacher put the students in groups of four. He did not talk about collaborative learning skills as an instructional goal, however.

- Independent exploration
  The teacher did not talk about this.

- Access to outside information resources
  No evidence of this.

- Support for higher-level thinking
  Yes. The teacher felt that this kind of experience would help students develop critical design and presentation skills.

- Creativity
  Yes. The teacher believes that this kind of multimedia design activity gives kids the opportunity to be creative in different ways. The fact that digitized photos and sounds are used as well as text and graphics opens the activity up to multiple modalities.

- Technology skills
  Yes. R. B. stated that technology helps to prepare kids for jobs when they leave school. They gain both technology experience (including troubleshooting) and confidence. R. B. says, *"Nobody leaves my class a technophobe."*

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***
  Yes. R. B. cited its effect on motivation as a major reason for using technology ("the ultimate carrot"), and the students we observed were very involved on their projects and seemed to have no problem focusing on their work. In an interview with 4 students from this class, they said they thought they would be bored if they did not have computers to use in school. The computers themselves seem to have a very motivating effect on them and tend to keep their attention.

- Attendance, time on task, discipline ***[kidbehav]***

  Yes. The students we observed were very involved on their projects and seemed to have no problem focusing on their work. I do not recall the teacher having to discipline the children, which says a lot about their motivation to work on their projects. R. B. reports that this atmosphere is a result of a classroom learning environment that the presence of computers helps to establish.

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  Because students during the first (observed) phase of the project were working on their own stacks, they tended to work independently more than they worked together collaboratively. Their biggest opportunity to work together on their HyperStudio projects was when they were using the Xap Shot Camera—because some students wanted their own picture in their stack, they asked another student to take a picture of them. We also observed students helping one another if they were having problems with a certain task or if they didn't know how to do something. For the second phase of the project, students produced multimedia science projects in groups of four. Such experiences help students develop skills in collaboration.

- Ability to manage own learning ***[selfreg]***

  Yes. Students are given long-term assignments with certain requirements (e.g., the elements that were to be included on each card) and then are responsible for managing their own time to complete the assignment over the designated period.

- Access to outside information resources ***[outinfo]***

  Students used outside resources in the second (science) report phase of the project.

- Support for higher-level thinking ***[higher]***

  Yes. The HyperStudio project supports higher-level thinking in that when students are making their stacks, they must decide how to divide up and organize their story so that it fits on five different cards. They must also decide what information (pictures, graphics, etc.) goes best with the different parts of text they will include on each card.

- Complexity of task students can accomplish ***[taskacc]***

Yes. The task students were asked to complete was highly complex and involved many different elements: Students either composed their stories at the computer using a word processing program, or they first wrote their story by hand and then typed it into the computer. They learned how to use a Canon Xap Shot Still Video Camera to digitize and save still photographs. They saved their pictures on floppy disks so they could later add them to their project. Students used HyperStudio to create their hypermedia projects. They recorded sounds using the Macintosh built-in microphone, and then imported that sound by creating a button for it. They created backgrounds for each card and had to decide what color each card would be. They imported text they had written previously into each card using a text field, and also imported still photos they had taken. In his interview, the teacher stated that technology helps a diverse group of students excel; he specifically noted that it is a great way to reveal the thinking and capabilities of LEP students.

- Learning on specific tasks ***[kidlearn]***
  Yes. In addition to learning technology skills (as described below), students have the opportunity to acquire skills in planning a presentation, structuring the presentation in terms of discrete parts, selecting the information to present, and designing materials that will have coherence and a strong impact.

- Creativity ***[create]***
  Yes. The process of writing a story and then making it come alive with HyperStudio's sound and graphic capabilities allows students to be very creative and to express themselves not only through words, but also through the pictures they draw and through the way they choose to put together their HyperStudio projects.

- Greater attention to how a product will be understood by others ***[audience]***
  No evidence in our observations or interviews although the activity has lots of potential.

- Technology skills ***[hackskl]***
  Yes. Through the process of creating a HyperStudio project, students learn a lot about using the technology. First, students use a word processing program to enter their stories into the computer. They either compose their stories at the computer, or they write their story by hand first and then type it into the

computer. Students also learn how to use a Xap Shot Still Video Camera to digitize and save still photographs. And finally, students learn to use HyperStudio to create their hypermedia projects. They learn to record sounds using the Macintosh built-in microphone, and then import that sound by creating a button for it. They learn how to create backgrounds for each card, how to import text onto each card using a text field, and also how to import the still photos they took.

EAST CITY HIGH SCHOOL DEBRIEFING

Site:	East City High School
Contact:	Mr. B., ACOT Coordinator and Math Teacher

1.0 Summary

East City High School's (ECHS) technology program is one of the original five Apple Classrooms of Tomorrow (ACOT).[1] Funded by Apple for the past 8 years, the program provides students with an intense learning experience in a "computer saturated" environment. The nine ACOT teachers use an interdisciplinary team teaching approach, incorporating the use of technology as a natural part of teaching and learning. Their teaching has become increasingly constructivist over the past 8 years as their role has shifted from that of "director" to "guide on the side." Collaborative planning is at the heart of the program. ACOT teachers are given every afternoon for common planning and are excused from noninstructional duties. Five classes of ACOT students have completed the program thus far, entering as ninth graders and continuing through their senior year. Although no quantitative evaluation data are available, ACOT teachers believe that students are far more confident, communicate better, work more cooperatively, and think on a deeper level than students not exposed to this technology-enriched environment. The ECHS ACOT program has recently implemented a Teacher Development Center (TDC) with funding from Apple and the National Science Foundation (NSF). The TDC provides an opportunity for teachers and administrators to observe the program for a full week and receive hands-on training in the use of technology in instruction.

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[1] The ECHS ACOT program will be referred to hereafter as "the ACOT program."

2.0 Context and Reform Overview

2.1 Education Context

- **Setting.**

ECHS is one of 17 high schools in their public school district, which is the 16th largest district in the nation. Like many districts, this one has been hit with staggering budget cuts in recent years (nearly $14 million over a 2-year period). The current superintendent (who took over in 1992) described ECHS as "a typical urban high school." Located in south East City in a working class neighborhood, the campus closely resembles the film location of Grease: a three-story brick building nearly 70 years old, wide locker-lined hallways, and traditionally arranged classrooms. The community that feeds ECHS is highly stable with respect to mobility; most ECHS graduates take blue collar jobs in the local area. Several of the teachers and administrators that we met were graduates of ECHS. ECHS faculty are nearly all veteran teachers and turnover is low (only five openings last year).

The ACOT program is nested on the schools' third floor, off the beaten path of most students and faculty. Four adjacent classrooms and two small teacher rooms constitute the ACOT space. The two inner classrooms house the more powerful workstations and are arranged for project work; the two outer rooms are equipped with enough individual Macs for each student and look more like conventional classrooms with individual workstations lined up in rows along long tables. The teacher rooms are positioned off the center classrooms. Here, the ACOT staff have individual desks and computers, phones, a refrigerator and coffee pot.

The atmosphere of the ACOT space is charged with excitement. It is hard to tell which element accounts for this—the non-stop parade of visitors (a Chinese delegation was there during part of our visit), the team of intense teacher observers (part of the Teacher Development Center), the raucous interaction of teenagers with each other and with the ACOT staff, or the ACOT staff themselves as they go about sharing strategies, problem solving, juggling schedules, planning, and making adjustments and readjustments to their plans.

- **Grade levels.**

The ACOT program at ECHS serves students in grades 9-12.

2.2 Demographic Information

The table below compares available district demographic data with that of ECHS and the ACOT program.

COMPARATIVE DEMOGRAPHIC INFORMATION

Demographic Variable	District	ECHS	ACOT
Teacher FTEs	4,700	87	9
Enrollment 9/93	64,000	1,176	120
% free/reduced lunch	41%	41%	41% (est.)
Number LEP or NEP		15-20	0
Number special ed.		86	0
% by ethnic group:[2]			
African-American	50%	35%	35% (est.)
"White and other minorities"	50%	65%	65% (est.)
Gender (% female)		51%	50% (est.)
Number of students with computers in home		< 20% (est.)	100%

2.3 Education Indicators

The next table displays educational indicator data by these same groups. ECHS students tend to score higher on the state proficiency test, which is administered to all 9th graders in the fall, than other high school students in the district. ACOT students clearly score even higher across all areas. ACOT staff focus on preparing students for these tests in the first several weeks of the ninth grade term. Selection factors likely account for some of the observed differences as well (see section 3.4 for more information on the selection process).

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[2] The district, school, and ACOT program provided ethnicity counts by the two categories.

COMPARATIVE EDUCATION INDICATORS

Indicator	District	ECHS	ACOT
% passing state proficiency test:[a]			
Writing	69%	75%	97%
Reading	69%	70%	94%
Mathematics	33%	34%	75%
Citizenship	52%	54%	88%
Drop out rates:			
Cohort rate	33%	35% (est.)	
Annualized rate	7%		4% (est.)

[a] Administered in the fall of ninth grade.

2.4 Reform History

- **Nature and when started**

  School staff cited ECHS's Effective Schools Program as the main schoolwide reform initiative. This approach to reform is closely aligned with Ron Edmund's correlates of effective schools: strong and effective administrative and instructional leadership that creates consensus on school goals, emphasis on basic and higher-order skills, safe and orderly school environment, climate of expectation that all children can learn, and continuous assessment of students and programs. A key feature of the effective schools process is site-based management which is operationalized through an instructional support team made up of classified and unclassified school staff, parents, and students. The instructional support team at ECHS (which includes one ACOT teacher) looks at performance data and develops a school "road map" in four areas specified by the district: (1) parent involvement, (2) narrowing the achievement gap by ethnicity and gender, (3) safe school environment, and (4) multicultural awareness. The team specifies activities for each area, designates responsible person(s), sets a schedule, and outlines an evaluation plan. The road map for 1993-94 covered these bases but lacked sufficient detail to make it a true blueprint for educational reform.

Although site based decision making is the hallmark of the effective schools process, the past ECHS principal remarked, "the concept sounds good, but since staff have had no training, they do not make real decisions." It does appear, however, that staff as a group are given a voice in professional development matters. Ironically, they voted out (62% to 38%) shared decision making along with increased staff development, which would have included training from ACOT staff in the use of technology.

Aside from the effective schools process, a number of innovative practices have been initiated at ECHS on a limited trial basis. We did not have the opportunity to document the extent to which these practices have been implemented, but they do indicate an awareness that there is more to school reform than an Effective Schools Program.

1. Interdisciplinary team teaching at the ninth grade level (science/math, and social studies/English) and at the 11th grade level (social studies/English) with vocational education students.
2. Common planning among a subset of teachers (just those with common planning time).
3. Thematic approach and cooperative learning with 11th grade vocational education students.

- **Reform Features**

  Nongraded groupings
  Extended periods
  Schoolwide themes
  X Teacher professionalization
  Authentic assessment
  Use of outside resources

There was some evidence of teacher professionalization (e.g., participation in shared decision making). None of the reform features were evident schoolwide.

- **Key Individuals**

The extent and nature of reform initiatives at ECHS appeared to be tightly coupled with district leadership, which has been in flux over the last decade.

The superintendent in 1986 (when the ACOT program began) was Mr. E. The key player in reform at that time was his assistant superintendent, Mr. F., who was credited by many interviewees as having the foresight and initiative to recognize the advantages of bringing technology into the classroom. In 1987, a new superintendent replaced Mr. E. and fired many of his top-level administrators, including Mr. F. District and school staff claim that district support for technology has not been the same since. This superintendent made ECHS a "scout school" for piloting site-based decision making, which was his favored strategy for school reform. His tenure was marked by very low staff morale and the demise of many programs. He was replaced as superintendent in 1990 by another superintendent who introduced the notion of effective schools programs and required all schools to participate. The current superintendent took over in 1992. He continued to promote the Effective Schools process, which was under way in all district schools. However, his signature reform initiative is Total Quality Management (TQM). With the help of executives from Xerox, he is phasing TQM in, beginning with district administrators. School principals will be next. He is also preparing an Urban Systemic Initiative proposal to NSF.

In terms of schoolwide reform at ECHS, the key player is the principal. She appears to be a good manager, sensitive to the fact that her veteran staff were not open to sweeping changes or time-intensive programs. To her credit, she has taken cues from the success of the ACOT program and begun integrating some of its non-technology reform features (e.g., team teaching, common planning), albeit on a limited basis, into the regular school program.

- **Funding sources for reform**
  The ECHS Effective Schools Program is funded by the school district. The other school level reform initiatives listed above receive no school or district special funding.

- **District/state/federal involvement/support**
  The district initiated the Effective Schools Program at ECHS and continues to support it as a strategy for reform. The district has not constrained ECHS in trying out team teaching, common planning, or thematic approaches, but these

strategies are not particularly promoted by the district. There was no evidence of a state or federal role in any of the schoolwide reform initiatives.

- **Role of tech in reform efforts**

  Part of initial reform concept
  X Emerging part of reform efforts
  Parallel effort

With the exception of the district's new Urban Systemic Initiative proposal, which reportedly includes a technology component (hence categorized as an "emerging part of reform efforts"), technology has had no role in any district level reform initiatives.

Since the era of the assistant superintendent who was hired in 1986 (Mr. F.), computers have been available to students at all grade levels. Every K-8 classroom had an Apple, there were Apple labs in every elementary and middle school, and there were both Apple labs and Mac labs in the high schools. When the new district superintendent took over in 1987, the equipment stayed, but there were no funds for new purchases or programs. District staff had drafted a technology plan, but were pessimistic about its implementation, noting that technology is not currently a district priority. According to one source, any innovations centering around technology in recent years have come from the "bottom up," not from "on high" as in the past.

At the school level, it is likely that the ACOT program influenced the initiation of common planning, team teaching, and thematic approaches with non ACOT teachers. This link was not made explicit by interviewees, however. Thus, a new category would be appropriate for this site, "helped shape new reform efforts."

3.0 History of Tech Applications

3.1 Incentive for Technology Use

The primary incentive for the ACOT program was the opportunity to fully equip a number of classrooms with the most advanced Apple technology (of choice) at no cost. Although computers had been used at the high school level

(Apple IIs), they were used only for programming classes and the computer clubs. The district and the teachers who were instrumental in writing the proposal to Apple realized that a program such as ACOT would allow them to bring computers into the lives of many students in a way that would otherwise not be possible.

3.2 When & How Application Started

The ACOT program had its origins in a popular "Summer Tech" program which the district sponsored with the support of local universities and business in 1983.[3] Summer Tech offered technology classes to the public at very reasonable rates ($25 for 10 hours). The district purchased 15-18 Apple II computers for the course with the intention that they would be given to district high schools for student and teacher use during the school year. The program attracted people from all over the country (up to 10,000 participants according one source) and caught the attention of Apple's regional office.

It was at this time that Apple became interested in finding out what difference computers would make in teaching and learning. Apple requested names of school sites that were using technology from its regional offices. In 1985, the district was nominated by Apple's regional office and invited to submit a formal proposal.

The Summer Tech instructors (the district technology coordinator and an ECHS math teacher) worked with an ECHS English teacher and an ECHS social studies teacher in planning the ACOT program and writing the formal proposal the following school year. According to one of the teachers on the planning team, they began by developing a guiding philosophy and goals. Another teacher described the proposal process as "a dreaming mentality" because they did not have to consider the costs of technology in planning the ideal classroom of tomorrow. The proposal focused on interdisciplinary team teaching and use of the computer as a tool. They selected Macs for the school and for each student to use at home. They submitted the proposal in March of '86 and were notified of its acceptance shortly after. Parents and students in the eighth grade were notified of the program and invited to apply. The proposal team brought on a science teacher to complete their two interdisciplinary teams English/social studies and math/science. Thirty students were selected from 100 applicants to begin the program in the fall of 1986 (see Section 3.4 below for more information on selection process).

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[3] One of the issues with programs that are over 10 years old is that different sources have different memories of "when and how" it got started. This summary captures those details that seemed consistent across multiple sources, including various undated articles.

The summer of '86 was an intense learning/planning period for the four original ACOT teachers. Not only were they becoming familiar with the technology, they were designing new ways to use what software existed for the Mac—MacPaint, MacWrite, MacDraw, and Excel—for educational purposes, something that had never been done before. "All that summer," according to one of the teachers, "we were deciding how to operate together, where were our strengths as a team? We learned together."

The ACOT program started in the fall of '86 with the newest of everything. The first day of school, the ACOT staff and entering students were greeted by TV cameras and reporters. One of the teachers recalled, "We were tripping over the reporters trying to get our seating charts done." The teachers remember working 80 hours a week at the beginning, including a full afternoon of joint team planning. They claim that during the first year, their teaching was still pretty traditional. "Teaming meant one *(teacher)* was on, the other was off. Any integration of disciplines was serendipitous." For example, the math teacher told us that he had done a ratio and proportion lesson one day. His team partner followed with a science lesson using maps, but instead of pulling out the maps, he put up the ratio and proportion information by accident. It turned out to be the perfect interdisciplinary lesson—drawing maps to scale.

The program developed and grew over the next 4 years, adding a new class of approximately 30 ninth graders each year. Additional teachers were selected to join the program as it grew. According to one of the original teachers, there were 3-10 applications for each slot. "We were looking for teachers who were willing to explore, but not necessarily experienced in technology." Over the course of these early years, the teachers began to work together in ways that integrated their subject matter more meaningfully. They continued to develop new ways to use technology and they continued to change in significant ways as teachers (see Section 6.2).

Each summer over the first 4 years, the ACOT staff were all flown out to Cupertino for joint training with other ACOT site teachers. This ACOT training focused on teaching in a constructivist manner, not on the technology per se.

3.3 Technologies Used

Y	Microcomputers
Y	Word processing
Y	Other LANs
Y	Spreadsheet
Y	WANs
Y	Hypermedia
Y	CD-ROM
Y	Animation
Y	Interactive videodisc
Y	Simulation
Y	Videocams and editing equipment

The following is a list of the **hardware** at the East City High School ACOT program:

COMPUTERS

- 160 Mac Plus Computers (for home and school use)
- 42 Macintosh II Computers (Mac IIx and Mac IIcx computers)
- 70 Macintosh SE's with floppy drives
- 5 Macintosh Quadra 800
- 2 Macintosh Quadra 700
- 6 Macintosh PowerBook Computers
- 10 Macintosh Portable Computers ("luggables")

PERIPHERALS

- 8 Apple Scanners
- 8 Apple Laser Printers
- 30 Apple ImageWriters (Only 6 of these are in use at the school. Teachers use these at home.)
- 8 CD-ROM Drives
- 4 Midi Keyboards

- 5 Laser Disc Players
- 28 44 mg removable cartridge drives
- 4 LCD projection panels (2 color, 2 black and white)
- 5 overhead projectors
- 2 TV's with VCR's on carts (one 40" TV, one 21" TV)
- 2 VHS VCR players and 2 monitors for dubbing
- 2 Hi-8 VCR players
- 2 Hi-Ban 8 mm cameras
- 1 regular 8 mm camera
- 1 Radius video card (s video in and out)
- 4 Video Spigot cards (video in only)
- 1 Raster Ops video card (video in and out)
- 2 Bar-code readers
- 1 Scantron

NETWORKS

- 8 Macintosh II's on Ethernet (MacJanet Software and Local Talk)
- 2 Apple Share servers (Mac IIfx - not installed yet)
- 3 telephone lines for telecommunication (America On-Line and CompuServe for students and AppleLink for Teachers)
    1 2400 Baud modem
    2 1200 Baud modem

The following is a list of the **NEW Software** at the East City High School ACOT program.

- Claris Works
- WriteType (the network typing version of this typing program)
- Adobe Premier
- Aldus Persuasion
- Passport
- Music Composer
- Finale
- Claris CAD
- Algebra I

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3.4 Target Grades and Curricula

The program targets grades 9-12 and all standard curricula areas. Eighth grade students and their parents attend an introductory session in the spring where they learn about the program and its requirements. Students must apply to the program. Approximately 30 students are selected randomly from the pool of applicants that score at or above the 37th percentile on the CTBS standardized test. According to the principal and ACOT staff, gender and ethnicity balance are considered in selecting students. Comparative demographic and achievement data are shown under section 2.2 for the most recent group of ACOT ninth graders.

3.5 Key School Players

Four key individuals were involved in the initiation and development of the program at the school level: Mr. A., the principal of ECHS at the time of the proposal and through the early years of ACOT; Mr. B., a math teacher; Ms. C., an English teacher; and Mr. D., a social studies teacher. Mr. A. had been the principal of the site where the Summer Tech program was held. He knew he was going to be moving to ECHS and he knew Mr. B., who was one of the Summer Tech instructors and known as "the building tech." He was also friends with the assistant superintendent who was hired in 1986, Mr. F. As Mr. A. put it, "It was a good match." Thus, the proposal named ECHS as the ACOT site. Mr. A. was extremely supportive of the teachers, giving them all the time they needed to plan and develop the program.

The three teachers worked with the district technology coordinator in putting together the proposal. A science teacher joined the program in its first year to team with Mr. B. These four original teachers planned the program and nurtured it through its first 4 years. Three are still with the program. Today, the program has nine teachers who work as a unified team, as well as in interdisciplinary dyads. They are instrumental in maintaining the creativity and energy of the program.

The current principal was a social studies teacher at ECHS before earning her doctorate. According to ACOT staff, she is very supportive of the program. She comes up to the ACOT area and meets with visiting groups, sees ACOT weekly reports, and talks to the principals of teachers who are involved in the Teacher Development Center. She has continued the policy of giving ACOT teachers the entire afternoon for collaborative planning and does not require them to perform routine noninstructional tasks, such as hall monitoring.

3.6 Outside Players in Technology

- **District involvement**

  Initially, the district was very instrumental in getting the ACOT program started. Mr. F., the assistant superintendent from 1986 and an ECHS alumnus, is fondly remembered by ACOT staff as a "visionary," because he recognized the potential of technology to change teaching and learning. He is said to have had a role in finding out about the Apple RFP and supported the teachers through the proposal process and first years of the program. Subsequent top-level district administrations have not been as strong advocates for the program. The current superintendent is positive toward the program, but not a particularly strong advocate. He pointed out to us, however, that he has protected the ACOT program from recent fiscal cuts.

  The district gives the school "extra staffing" for the ACOT program by funding more teachers than would normally be required for the course load. It also pays the full salary of the TDC coordinator, half the salary of the ACOT coordinator (Mr. B.), and arranges for and pays for substitutes to cover teachers participating in the TDC program.

  Unlike top-level district administrators, the district technology coordinator has been a consistent source of behind the scenes support for the ACOT program since its inception. She was described by the former principal (Mr. A.) as "the driving force in the success of the program." She was responsible for acquiring the Apple IIs for the Summer Tech program that caught the eye of Apple. She worked side by side with the proposal team in writing the ACOT proposal and was bid as co-director with the ACOT coordinator. The district technology coordinator found it easiest to support the program when Mr. F. was the assistant superintendent. Since then, she has not had the resources to participate as fully in the growth of the program as she would like.

- **State/federal involvement**

  There has been no state or federal support for the ACOT program. The NSF is contributing funding to the TDC by supporting the salary of the national TDC coordinator.

- **Business involvement**

  Certainly the most important outside player in this program has been Apple. According to Mr. A., "Apple's support and commitment to this from an educational point of view has been exceptional." In 1985, the National ACOT program began as a collaboration between Apple Computer, Inc. and several school districts around the country in an effort to explore the impact of computer saturation on teaching and learning in K-12 classrooms. ECHS was one of five school sites supported through the ACOT program and the only high school. Apple provided all the hardware and initial software. They have provided countless hours of inservice over the past 8 years of the program, beginning with on-site technical support and consultation in the summer of '86, and continuing with summer institutes for all ACOT teachers in Cupertino from '87-'89. They have sponsored a variety of research/evaluation projects, some in collaboration with a nearby state university, and have disseminated information about the program nationally and internationally. Apple has contributed to the professionalization of the ACOT teachers by giving them opportunities to make national presentations and teach others about their use of technology in teaching. Apple is a partner with the district in the TDC, the program's primary dissemination vehicle (see Section 7.1). It pays for the TDC coordinator's travel and communications and provides the technology.

With the exception of funding of a large proportion of the ACOT coordinator's salary and involvement in the TDC, Apple's contribution to the program in recent years has decreased. ECHS has received no new equipment in the past 2 years and summer institutes have not been provided for 4 years. Apple renews their contract with ECHS on a yearly basis.

- **Foundation involvement**
  None.

- **Parent involvement**
  Parents of students in the ACOT program have not played a major role in the program. They did, however, help to raise money for air conditioning the third floor of ECHS, where the ACOT classrooms are located. ACOT staff report that they have tried numerous techniques to involve parents (e.g., parent newsletter), but it has even proven difficult to get them to attend the mandatory introductory meeting held at the start of the school year.

- **Other outside influences**
  A nearby state university has also had a role in supporting the ACOT program. They were partners in the initial proposal and have participated in a number of research and evaluation efforts. Recently, a state university faculty member assisted the TDC coordinator in planning teacher development activities.

4.0 Overview of Tech Uses

Teachers and students in the ACOT program use technology in so many different ways from day to day and have written and videotaped records of projects they have completed in the past. As indicated, some of the technology uses described below were not directly observed during our site visit, but we learned about them through literature given to use by the coordinator of the program. It is important to note that the ACOT teachers do not always use the technologies for tutorial, exploratory, communicative, or tool-like purposes for all of their lesson plans, but alternate their uses as they see fit or as their schedules allow.

4.1 Student Uses [*kiduse*]

- **Tutorial**

  Although the ACOT teachers do not openly discuss their use of technology for tutorial purposes, we observed several instances of this occurring. In the social studies classroom, students were using MacDraw to fill in electronic worksheets the teacher had created and posted for them on the network. He was teaching a unit on Africa's geography (he called the lesson Africa Web) and instructed the class to use their textbook to fill in the blanks on the three worksheets. Students were also instructed to draw a climate map of Africa and label the geographic regions as they were listed in their textbook. This seemed to be a very traditional style of teacher and textbook directed teaching with the only difference being that the worksheets were on the computer. In discussing the lesson, the teacher said the following week's lessons would focus on helping students make the connections between the map, charts and the country's economy.)

  Also, when students are learning a new software program such as programs considered to be "tools," they are taught as a whole class with the teacher transmitting information to them. For example, the ACOT coordinator's lessons on how to use Excel begin with the transmission model of instruction and, as time permits, are later followed by students having time to explore what they have learned on their own. He also used GeoExplorer with the students in a tutorial-style manner by asking them to use the software to construct a triangle and label the angle bisector, median, and the altitude.

  The East City ACOT program also has a few keyboarding software packages for students to learn how to touch type. However, we did not observe any students using them.

- **Exploratory**

  During our one week site visit, we did not observe students using the technology for exploration. However, there have been many instances in the past of their using the computers and other technologies for exploration. The following is one example of past curriculum project using technology for exploration.

Celebrating the Chinese New Year - A social studies teacher and an English teacher joined efforts to design a unit on China for 10th graders. Their students visited the "Son of Heaven: Imperial Arts of China" exhibit at a local museum and were given access to the museum's videodisc which contained images of the artifacts from the exhibit, a database of the artifacts which included the curator's notes on them, and "dozens of informational books on Imperial China."

"We always aim for some student-centered knowledge construction, but we usually do try to transmit some knowledge first. This time, we would let the students plunge right in and let the students uncover their own topics. The only thing we decided for sure was that the culminating event would be a sharing of student projects on the upcoming Chinese New Year. We asked students to work in groups of three to explore the videodisc and database to come up with possible topics for an in-depth exploration." Groups were also allowed to decide how to present their material using videodiscs, scanners, MacRecorders, Macintosh II computers, and cartridge drives. (from "Literacy Matters" Vol. IV, Number 1, Winter 1992, pages 6-8)

- **Communication**

  East City High School students and teachers use modems and communication software for local area networks and wide area networks.

LOCAL AREA NETWORKS

MacJanet is a communications software package used at the school site for teachers and students to communicate with each other via Ethernet (i.e. a hard wire connection not using phone lines). All of the Macintosh computers in the 4 ACOT classrooms at East City are connected via an Ethernet connection and are equipped with MacJanet software. Teachers and students have their own private storage space on the network where they can store their work.

Students use the network from home or on site to turn in assignments for their classes rather than handing in paper copies. Teachers also post the assignments on the network for students to download at their leisure. "There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class. Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Students have access to public programs on the file servers requiring fewer disks to be carried by the students. Students working on interdisciplinary projects can communicate and share information at all times without necessarily being scheduled in the same room at the same time." (from one the ECJS ACOT handouts called "Apple Classroom of Tomorrow: Networks in Education?") With this network, students also have the opportunity to work on any of their assignments from other classes from any computer. For example, if a student is in social studies class and has already finished the assignments for that class, she can log on to the server with MacJanet and work on an assignment for another class which she may not have completed.

WIDE AREA NETWORKS

Teachers and students also have access to America On-Line and CompuServe which are used for instructional purposes, although we did not observe them using it in the classroom during our site visit.

- Tool

Most of the software available at East City ACOT falls under that category of general-purpose tools for accomplishing tasks. However, at the time of our observation, teachers were instructing students to use the "tool" software for teacher-directed tasks. For example, in the social studies class, students were logging on to the network using MacJanet, down loading the templates the teacher had created, and referring to their text books to fill in the blanks on the electronic worksheets using MacDraw. Students were also instructed to draw a climate map of Africa and label the geographic regions as they were listed in their textbook.

The English teacher's class was using an Excel spreadsheet as a database to keep track of all of the different characters, settings and scenes in the novel Great Expectations. Students were allowed to enter any information into their data base as they saw fit. The science teacher also had his students use HyperCard to create an animation of the Big Bang explosion and to create a simulation of the time that passed from the evolution of the world to present day.

Literature given to us by the coordinator of the program revealed the following other uses of the technology as a tool. The examples below are from "Literacy Matters" Vol. IV, Number 1, Winter 1992.

Students' Resumés. Several students used word processing programs to create their own resumés for after-school employment or for entry into college.

Student Newspapers - Students used PageMaker and Microsoft Word to construct their own newsletters and to create a newspaper for the Kiwanis Club. The Kiwanis Club provided students with handwritten articles, photos and advertisements, giving the students the entire responsibility to prepare a camera-ready newspaper layout.

Multimedia Art Projects - Juniors and Seniors in advanced French and Spanish classes developed full-color multimedia projects on French and Spanish artists using SuperCard, MacroMind Director, a video camera, a digitizing card to digitize the video, and a MIDI keyboard to "blend music background with recorded voice and live video sound." Their SuperCard stacks were written in French and Spanish.

Video Portfolios - Because the knowledge students acquire through the ACOT program is often difficult to represent in text format, the ACOT coordinator had his students create video portfolios to show off their most marketable technology and problem-solving skills. Students were given the following guidelines: the videotape could only be 5 minutes long, it should be targeted to an audience of prospective employers an college admissions personnel, it should highlight their skills and interests, and it should emphasize skills not easily captured in a text resumé.

4.2 Teacher Uses [*tchuse*]

- **Communication**

ACOT teachers use modems and communication software for local area networks and wide area networks.

LOCAL AREA NETWORKS

ACOT teachers use the network to post assignments for their classes rather than handing out paper copies.

"Now, these materials can be distributed within 1 minute to all students [rather than the teacher having to take 20 minutes from his/her lunch break to make copies]. There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class.

Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Teachers can collect materials at their convenience rather than taking away valuable learning time while with the students.

WIDE AREA NETWORKS

ACOT teachers also use AppleLink software and a modem to communicate with researchers at Apple Computer, Inc., other ACOT teachers across the country, and other outside organizations through a wide area network. Each teacher in the East City ACOT program has his/her own AppleLink address. However, the coordinator of the program has taken over the responsibility for checking everyone's AppleLink messages once a week.

Teachers and students also have access to America On-Line and CompuServe which are used for instructional purposes, although we did not observe them using it in the classroom during our site visit.

- **Presentation**

  ACOT teachers use many different technologies for presentation purposes.

  Large television monitors attached to VCRs and laser disc players (on rolling carts) are transferred from room to room as needed. Some teachers use the VCR's and laser disc players to present information to students in class. For example, during our visit, one teacher was showing her class a laser disc movie of Great Expectations. Students were also reading the novel and discussing the differences between the novel and the film on laser disc.

  Teachers also have access to LCD projection panels which allow them to project images directly from the computer screen. For example, a teacher was teaching a geometry lesson using this type of set-up by having the students take turns showing the class different ways to construct a triangle with a geometry software package.

- **Instructional Management**

  ACOT teachers use different types of software for instructional management. For example, the science teacher uses a HyperCard stack to outline and illustrate his lesson plans. As the lesson progresses, he simply adds more cards to the stack as needed. The ACOT coordinator uses Microsoft Excel to keep track of his students' grades and assignments, and posts an Excel-generated list of students assignments in the classroom so they know what assignments they have completed and which ones they still need to complete. The ACOT coordinator also uses Excel to organize the overall ACOT class schedules.

5.0 Implementation Details

5.1 Problems Encountered

- **Difficulties in selecting hardware/software**
  No. The decision to use Apple hardware was not at all difficult given that Apple provided funding for the ACOT program. The proposal team had no trouble specifying Macs as the hardware of choice because they believed the Macs would be the easiest for students and teachers to use. They were aware, and somewhat fearful, that the lack of educational software for the Mac in 1985 would be a problem. They "selected" the only software that was available—MacDraw, MacPaint, MacWrite and Excel.

- **Difficulties in obtaining hardware**
  No, initially. It was not a problem to obtain hardware because of Apple's contribution through the ACOT program. In recent years, however, the equipment has become dated. As one of the newer ACOT teachers noted, "Technology gets old in a very short time." This teacher said that curriculum planning and project assignments are more difficult because the more powerful hardware is located in just two of the classrooms. There are limits to what can be done in the other two classrooms.

  For a period of time (1990-92), the program did not receive any new equipment. The ACOT coordinator relates this "lull" period to a parallel lull in the professional development of the ACOT teachers. He illustrated this point with a graph showing the growth curve for ACOT teachers over the 8 years of the program (see Exhibit 1). The flat portion of the curve coincides with the lack of new hardware. The upswing in the curve in '92-'94 was explained by receipt of new multimedia tools and high-powered Macs. Although some new equipment has been sent in recent years, the program would clearly benefit from newer, more powerful hardware.

- **Difficulties in obtaining software**
  Yes, initially. When the program began in 1986, there was no educational software for the Mac. But this worked more as a facilitator

than a hindrance because it promoted the program's concept of the use of technology as a tool. The ACOT teachers created ways they could use business software for instructional purposes. Now, it does not appear that they have any trouble developing, adapting, or obtaining software.

- **Difficulties maintaining systems**
  Yes, initially. The ACOT coordinator said that in the early years, he personally had to unhook faulty equipment, carry it down three flights of stairs, and drive it to the local Apple dealer, racing to arrive before closing time. At times he even had to cover the computers in plastic to protect them from the snow. Apple recognized this problem and sent the ACOT coordinator to North Carolina to become a certified Apple technician, which would allow him to work on the computers himself while they were under warranty. That helped ease the situation, but still left the ACOT coordinator in the position of being responsible for all maintenance. In 1990, the district technology coordinator stepped in and arranged for on-site service through Computer Land. Now, maintenance is not a problem, but maintenance is needed more often because much of the hardware is old.

- **Theft/vandalism**
  No. This is remarkable given that each ACOT student receives a computer to use at home. Over 8 years of the program, only one computer was not returned. They have had about 10 instances of tardy returns. But after instituting a policy of holding students' school records until computers are returned (which prevents them from enrolling in any other school), they have not had problems.

- **Teacher lack of knowledge/fear**
  No. Although only two of the original four teachers had backgrounds in technology use, lack of knowledge has never been a problem for this program. The teachers who were new to technology (two of the original four and all of the teachers who joined after the first year) learned from the other teachers. The selection criteria for ACOT teachers was willingness to try new things, not expertise using technology.

- **Lack of time for learning to use technology or developing technology-related curriculum units**

  No. The ACOT teachers used the entire summer prior to the first year to learn the technology, experiment with existing software, adapt it for educational uses, and plan lessons. During the school year, ACOT teachers have the entire afternoon to plan, experiment, and coordinate.

- **Disappointing results from using technology**

  No. Although there have been no recent formal evaluations, the ACOT staff, ECHS school administrators, and district administrators are very satisfied with the results of the ACOT program. They cite the higher proficiency test scores of ninth graders, (see Table in Section 2.3) the fact that most ACOT students go on to college, and the fact that many ACOT students receive full scholarships to college based on their technology expertise.

- **Poor alignment of technology w/instructional goals**

  No. The ACOT teachers designed the program to complement the district's graded course of study. The ACOT teachers firmly believe that technology supports their teaching and students' learning.

- **Lack of funds**

  No, initially; yes, now. The program received adequate resources from Apple to begin the program, both in terms of hardware and software and technology consultation. In recent years, however, they have not been as fully supported and the fact that much of their hardware is dated has limited the program.

- **Resentment from nonparticipating classes/schools**

  Yes. This is definitely a problem that plagues the program. As the superintendent put it, "ACOT is a stand alone enriched environment." Despite the ACOT staff's diligent efforts to share their expertise and open ACOT's doors to others, relatively few ECHS teachers have taken advantage of the ACOT facilities or ACOT expertise. According to an informed source, only 10% of the ECHS faculty have been interested in receiving any inservice in technology from the ACOT teachers. Many of the non-ACOT teachers feel that the ACOT teachers "have it easy," with their afternoons free for planning, a lighter course load, "brighter" students, and release from routine noninstructional duties. Whether accurate or not, this is the perception of many teachers we spoke with.

- **Lack of technical support**
  No. From the reports of ACOT teachers and the district technology coordinator, the program has received adequate technical support. Much of this is due to the fact that the ACOT coordinator is a certified Apple technician.

- **Failure to see fast positive effects on test scores**
  No. Test scores are not an issue. With the exception of the state proficiency tests, no one at the site referred to test scores as a relevant measure of ACOT student outcomes.

- **Other Problems**
  Yes. An external source who was familiar with the development of the program felt that the ACOT program has suffered, especially in recent years, from lack of an authority base. "No one feels that they have any say over ACOT. No one will correct problems that everyone realizes exist." The principal is not in charge; Apple takes a hands-off stance; and although there is an ACOT coordinator, there is a strong shared decision making ethic.

  Another problem noted by external sources is that several of the ACOT teachers have not continued to grow professionally. One person noted, "In the early years, the afternoons were really used for collegial planning as intended, but this doesn't happen anymore." This authority issue was not raised directly by any of the ACOT teachers. However, the ACOT coordinator did point out that the professional growth curve was related to the newness of the technology and acknowledged that there was definitely a "flat" period. (See Exhibit 1).

  The upshot of this seems to be that the program in its eighth year is not as innovative and powerful as it once was. This may be due to teacher burnout, lack of new technology, inconsistent district support, lack of state support, lack of interest on the part of most ECHS teachers, and petty jealousy on the part of some ECHS teachers, less attention and funding from Apple, or a combination of the above.

5.2 Strategies for Overcoming Barriers

- **Inservice training/release time**
  Yes. ACOT teachers have received adequate training and release time. An Apple consultant flew out to East City and provided on-site technical assistance and consulting the first summer; all ACOT teachers were flown to Cupertino for summer institutes for the first 4 years; Apple has provided on-going technical assistance and advice on an as-needed basis, especially in the early years; local faculty from the state university have provided support and training; and the district has supported occasional local technology workshops for ACOT staff. Since the program's inception, ACOT teachers have been given the entire afternoon for planning, rather than the usual one period. They reportedly used at least one of these afternoons for team planning in the early years, but in recent years, planning between interdisciplinary team members has been done on a more informal basis. The group planning that we observed centered more on scheduling and logistical issues than instructional issues.

- **Involvement of outside experts**
  Yes. Numerous experts from Apple have contributed their expertise, both in technical terms and in giving the teachers feedback based on their observations and research. Faculty from the state university have also been instrumental in supporting the program.

- **Creative fund raising**
  No. This is not a strategy that has been utilized and is clearly needed at this time, given budget cuts at the district level and reduced support from Apple.

- **Other Strategies**
  Yes. The principal way that the ACOT teachers have dealt with barriers is through collaborative problem solving. They trust one another, respect one another, and work extremely well as a team. Since there is little (if any) internal competition, team members feel comfortable asking each other for help and sharing concerns/problems. If a strategy does not work, they keep experimenting until something does.

5.3 Facilitators

- **Technical support on hardware/software**
  No, initially. As noted above, the ACOT coordinator had difficulty in maintaining the hardware in the early years of the program. Eventually, he received inservice to become a certified Apple technician. But more importantly, the district recognized the burden on him and arranged for on-site maintenance.

  The issue of support for software is not relevant because the ACOT teachers developed innovative instructional applications for business software for the Mac on their own. This "deficit" created the opportunity for the teachers themselves to construct their own best use of technology. The ACOT teachers, and now the ACOT students, are still their own best source of tech support for both hardware & software.

- **Teaching skills**
  Yes. Each of the ACOT teachers had earned a reputation as an outstanding teacher before joining the program. As one teacher put it, "I was a really good teacher before ACOT." Nevertheless, she described herself as very traditional (e.g., lecturing in front on the class in a didactic style, always following a structured lesson plan, tolerating little noise or disruption, relying on objective tests for assessment). But each of the ACOT teachers also came to the program with the courage to look critically at his/her own teaching and to change it when it didn't work in the ACOT teaching environment. As noted earlier, one of the selection criteria for teachers was "willingness to try new things," a trait that clearly

has been predictive of professional growth among ACOT teachers (for more on this topic, see Section 6.2).

- **Technical assistance on integrating technology into instruction**
  No. No one knew how to integrate the use of Macs/Mac software into instruction. ECHS ACOT teachers have done this on their own.

- **Supported time for teachers to develop skills**
  Yes. Teachers were given time in '85-'86 to prepare the proposal, the summer of '86 to plan the program, every afternoon during the school year to develop skills and plan, and several weeks each summer in the first 4 years to attend ACOT summer institutes in Cupertino.

5.4 Costs

Apple provides $25,000 per year to support half of the ACOT coordinator's salary. This contract is renewed yearly. Other ACOT teacher salaries are paid by the district. However, as noted earlier, the ACOT program is given more teachers per student than is the norm in ECPS.

Apple provided 12 of the computer systems and the city public schools provided 6 of the computer systems.

The TDC (see Section 7.1 for description) is funded by NSF at $1.2 million over 3 years. NSF provides each participant with a $1,200 stipend, an LCII, and an ImageWriter printer for classroom use.

6.0 Impacts

6.1 Effects on Students

- **Motivation**
  Yes. Although we did not specifically prompt teachers on this outcome, one teacher said that ACOT has had the effect of "moving kids out of the East City side," meaning that because the students have more

confidence and have seen what is possible, they are more willing to try something new and more likely to move beyond the career patterns of their parents by going on to higher education. This is despite the fact that the students selected for ACOT are not typically college-bound.

- **Self-esteem**
  Yes. Self-esteem was the outcome cited most often by teachers and administrators. One of the English teachers said that ACOT students are "empowered" because of the close-knit "family atmosphere" of the program. Another ACOT teacher said students feel better about themselves because they see themselves as doing something the rest of the kids in school aren't doing, failure doesn't enter their minds. Other ACOT teachers felt that students benefited from the public exposure they get through the program. They become comfortable with ushering groups of important people, speaking in front of groups, being observed, and answering questions. These social skills pay off in college interviews and general life skills.

- **Attendance, retention, disciplinary rates**
  Yes. Attendance of ACOT students is much higher than the norm for ECHS. However, it should be noted that attendance is one factor considered in the selection of students. With respect to retention, the program generally loses one or two students in the upper grades each year (out of 60 juniors and seniors). One ACOT teacher said, "Some students don't adjust to the social aspect of isolation *(from the rest of the school).*" Others reportedly drop out because they find the curriculum too difficult.

- **Technology skills**
  Yes. ACOT students definitely graduate with exceptional technology skills. According to ACOT teachers, all of the graduating ACOT seniors in 1990 received academic scholarships because of their technology skills. One student was so skilled, he left college to earn a salary of over $80,000. ACOT students are regularly called upon to provide technical support to non-ACOT teachers and students. Several students have

started their own business and many help family members using technology. Another aspect of acquiring technology skills is the appreciation students gain from seeing how technology is integrated into their lives. The ACOT coordinator gave an example of how the students were aware of the way graphic arts came into play on television. "Are we developing skeptics? Maybe!"

- **Other Student Outcomes**

  Yes. Teachers cited the following additional positive effects on students:
  - Improved ability to communicate, which they attributed to students' interactions with visitors and cooperative group work.
  - Improved ability to think and to synthesize information. For example, using multimedia technology helps students to pull together multiple aspects of an issue in a cohesive theme. Students are more likely to provide explanations for phenomena to teachers, rather than the other way around.
  - Improved ability to work cooperatively in groups and increased willingness to help other students.
  - Better retention of information compared to students in traditional nontechnology classes.
  - Increased self-questioning of own work. Instead of just turning an assignment in, students are more likely to critique it themselves first.

6.2 Effects on Teachers

- **Inclination to assign complex tasks**

  Yes. This was not one of the main effects that the ACOT teachers talked about. However, long term, interdisciplinary projects are the norm in the program. One of the newer teachers did note that since joining the program, she has higher expectations for students and assigns more project work.

- **New instructional strategies**

  Yes. Each of the ACOT teachers talked about dramatic changes in her/his teaching since joining ACOT. The ACOT coordinator pointed out that while all the teachers have grown as teachers, their growth curves have not been the same. Two of the nine teachers had had some experience teaming, planning collaboratively, and focusing on student centered work. For the others, these practices were all new, along with the technology. The types of changes talked about across teachers include the following:

- integrating another discipline in teacher's own discipline
- team teaching
- teaching in a constructivist manner
- switching from an emphasis on whole group instruction to more cooperative learning
- experimenting with new ways to assess student learning. For example, having students give evidence of what they have learned by building portfolios, having students demonstrate their new knowledge in some tangible manner, shifting the weight from "knowing the facts" to application, conferencing with students about how they think they are doing and evaluating their work collaboratively, using multiple pieces of information for assessment.
- becoming comfortable using a different teaching format each day, from class to class, or within classes
- becoming comfortable with sudden changes in plans
- accepting that the teacher is not the "expert" anymore. As one teacher said, "The kids are going to outshine you every day."
- giving up the "director" role, the "imparter of knowledge" role, and becoming a "guide on the side," "mentor," "resource," "facilitator." One teacher said, "Coaching is more what I do in ACOT than what I used to call teaching."
- changing expectations about student outcomes—that they will be different for each student and that students will take different amounts of time to achieve them
- increased openness to "play" and "experiment"
- working more with students as partners and asking them, "What do you think?"
- becoming comfortable not getting through all the material

- **Self-esteem and sense of professionalism**

  Yes. Although none of the teachers claimed to have a better self concept or be more of a professional, several teachers commented on the changes they saw in each other. For example, the ACOT coordinator was very impressed with the extent to which one of the newer teachers had become more and more confident since joining the program and noted a parallel increase in the extent to which she contributed to team decisions. The teachers have had many opportunities to make professional presentations, write professional papers, and provide training/technical assistance to other teachers.

- **Communication with other teachers**
  Yes. Team teaching and collaborative planning are key aspects of the ACOT program. These activities were new for most of the nine ACOT teachers. Each team member spent considerable time getting to know the other team member's instructional goals and discussing ways that they could integrate their curriculum. Once a certain level of familiarity was reached, the need to communicate tapered down. When asked to estimate how often they plan collaboratively, one team told us, "every other day." Others said, "as needed." The team as a group meets once a week for scheduling and logistic matters, and once a month for planning projects and curriculum.

- **Use of their time**
  Yes. ACOT teachers teach only half a day and may use the afternoons for skill development and collaborative planning. In the program's early years, the teachers used nearly all their time (one teacher estimated 80-hour work weeks) to plan the program. Now, their work load has become more reasonable, but each of the teachers claims that the ACOT teacher role is far more demanding and time intensive than regular teaching.

6.3 Effects on School Climate & Processes

- **Increased linkages with outside organizations, resources**
  Yes. The program established a strong link with Apple and with the state university. Literally hundreds of representatives of outside organizations have visited the program. ACOT teachers network with teachers from other ACOT sites and with persons involved with technology and education all over the country. In terms of resources, Apple and NSF have been the main contributors.

- **Enhanced role as magnet**

  No. It does not appear that students from outside the ECHS catchment area are drawn to the school because of the program. Because the ACOT program is limited to a subset of the ECHS population (roughly 10%), the school as a whole could not be called a "magnet."

- **Other Effects on the School**

  Yes. Several other school effects were noted by various sources. First, the ACOT teachers themselves have proven to be an "in-house staff development capability." The first TDC summer institute was offered exclusively to ECHS staff. But as noted earlier, relatively few ECHS staff (about 10%) have taken advantage of ACOT staff expertise. Secondly, the program has brought considerable visibility to the school and to the district. The superintendent said, "The ACOT program gives character to [the school district]. It has been a lighthouse for the implementation of technology in the classroom." Third, the program has served as a model within the school for the Community College Preparation Program (CCPP). This program uses an ACOT classroom and equipment in the afternoon and incorporates team teaching, interdisciplinary curricula, and cooperative learning.

6.4 External Accountability Measures & Their Influence

There are no external accountability requirements for the ACOT program. However, the state-mandated ninth grade proficiency test does influence ACOT instructional activities in the first weeks of the school year as teachers prepare the ninth-graders to take the exams.

6.5 Evaluation

Note, there is no recent quantitative evaluation data on the ECHS ACOT program. ACOT staff kept surprisingly little data on students. For example, we were not able to obtain counts by ethnicity (staff estimated), documentation of ACOT student characteristics used for selection purposes, or ACOT retention

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rates. An outside source noted that most of the research focused on the ACOT program has been of a qualitative nature.

- **Test scores**
  The program collects no comparative achievement data on ACOT students for evaluation purposes. Mandated state proficiency tests are given to the entering ninth graders, but these data are not outcome measures.

- **Retention rates**
  No data were available on retention rates in the ACOT program or relative to ECHS generally. One ACOT teacher estimated the number of students who leave the program at about two a year, in the upper grades.

- **Attendance**
  No data were available on attendance rates in the program or relative to ECHS generally. Several ACOT teachers told us that attendance is much higher in the ACOT program.

- **Discipline rates**
  No data were available on discipline rates in the program or relative to ECHS generally.

- **Teacher turnover**
  Only two teachers have left the program. One teacher, who was among the original four, was "burnt out;" another left because he was not well matched to his team partner.

7.0 Reflection and Advice

7.1 Dissemination

The Teacher Development Center (TDC) is the program's primary vehicle for dissemination. This program is jointly funded (along with two other school sites) by Apple and NSF. Now in its second of 3 years, the program has a full-time coordinator, who is a teacher on special assignment. The ECHS program has two components, 4-week summer institutes and 1-week school year practicums.

The first summer institute occurred in 1992 and targeted 28 city public school teachers. This summer, the institute will include 24 teachers, half from within and half from outside the district. The institute training is provided byfour ACOT teachers. The training is "situated teacher development" (i.e., modeling of behavior to be learned, hands on activities, time for thinking, and follow-up support). In the summer of 1992, 9th grade students participated in the institute; in the summer of 1993, grades 3 through 9 participated; and in the summer of 1994, grades 6 through 9 participated in the institute for 2 out of the 4 weeks to give participants the opportunity to observe and use technology for instruction. Participants were provided with LCIIs in past years and with LC 575s in 1994, and ImageWriter printers for their own classroom use. The TDC coordinator provides follow-up support to the extent she can (her goal is two visits per year per participant), although this has not always been possible due to her heavy workload.

The practicums were instituted in the fall of '93. Their purpose is "to give the participants those experiences they will need to implement similar instructional activities in their classrooms/school/district." Because the practicums focus on dissemination (similar to a training of trainers model), teams of school staff are encouraged to participate (teachers, counselors, and administrators). The practicum experience, which takes one full school week, exposes participants to collaborative activities, interdisciplinary and knowledge building activities, and alternative forms of assessment. Beyond observing these practices, participants are expected to document their observations with video, which they will share with their home school. The practicum is structured so that participants have ample opportunity to interact with students, ACOT teachers, and other participants regarding their observations and learning. Time is scheduled for reflection, discussion and synthesis of information. Additionally, training is provided on using technology and software (e.g., laser disc, CD-ROM, Claris Works) for teaching and learning in the classroom. As part of the practicum, participants develop implementation plans to transfer their learning to their own circumstances.

At the time of our visit in February, the TDC had already sponsored nine practicums, which together affected approximately 81 school staff. Follow-up is provided through local school sites and phone calls. The practicum includes an on-line participant background survey and a post-practicum questionnaire.

7.2 Plans

The ACOT program will continue in its current format if funding from Apple continues (there was no expectation that it would not, only that it would not increase). Future plans are focused on the development of the TDC and continued dissemination of the program.

7.3 Advice

Mr. A., the past principal of ECHS, felt that the program would have been more successful if it had focused more on involving all teachers in the school rather than just a few. He recognized this as a quality versus quantity issue and that ACOT has focused on quality. He recommends that if all teachers cannot be involved because of costs, concerted efforts be made to keep all teachers informed and make the technology accessible to all. "The unknown and lack of understanding is the biggest barrier to a program."

Several teachers had advice for other teachers. "Be flexible!" "Be ready to change your plans and be willing to handle frustration." "Wear pants so you can crawl around on the floor looking for cables!" "Let students explore technology, touch it, don't worry about breaking things." "Try to become comfortable with one software program to start, otherwise it can be overwhelming. Information from one program will transfer." "Try not to use technology for only drill and practice, try to stretch your teaching." "Let go of the control." "Give kids some parameters, then let them go." "Leave students alone!"

One teacher had advice for administrators. "Leave teachers alone!" He believes that teachers cannot do their jobs if they are told what to do or constrained by state or district policies. If teachers are constrained, they will constrain the kids. Both teachers and students "need to be free."

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	Africa Web
Teacher:	K.J.
Site:	East City High School ACOT Program Midwestern city

1.0 Summary [*sum*]

In K.J.'s 9th grade Social Studies class, students were using MacDraw to fill in electronic worksheets he had created and posted for them on the Ethernet classroom network. He was teaching a unit on the economic advantages and disadvantages of Africa and how they related to the geographic location and climate of that country. When we observed the students, they were using their text books to fill in the blanks on three worksheets he had created.

2.0 Classroom Context [*context*]

This classroom, along with all of the ACOT classrooms, are used interchangeably by all of the ACOT teachers and students in grades 9 through 12. On a weekly basis, teachers plan out which classrooms will be used for each of their classes, depending on what projects are currently going on.

The rectangular shaped classroom was laid out with students' tables/desks clustered together in groups of 5 next to the walls with one aisle down the middle of the room. There were approximately 35 Mac Pluses in the room, one Mac II, a laser printer, an overhead projector with an LCD panel and a rolling cart with a TV, VCR and laser disc player. There were between 30 and 35 ninth grade students in this class, and two teachers. K.J. was the main teacher and C.C. was his team teacher who, in this case, served mainly as a back-up support for him. During our observation, students were given instructions to log on to the network and download the files they would be using for this class. They were then to proceed through the exercises independently, but were allowed to get up and help each other with any part of the assignment.

K.J. has been teaching for 29 years and will be retiring at the end of this school year. He has taught many different social studies subjects in his career. He taught at an alternative high school and was able to practice team teaching at that site before coming to East, where he has been teaching for 3 years. He first learned how to use an Apple IIe in 1987 through help from his son, but the East ACOT program was his first experience at using technology with students. He considers himself to be an observational learner and feels he learned how to be proficient at computers by watching and imitating other teachers.

C.C. team teaches with K.J. and as one of the original team members in the ACOT teaching staff, she has been teaching at East ACOT for 8 years. She began teaching in 1970 and is now in her 24th year of teaching. Before coming to the East ACOT program, she taught middle schoolers in the area. "She knew very little about computers but had expertise in team teaching and was well known for her willingness to try out new techniques and strategies in the classroom."

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

Interdisciplinary
Project-based
Collaborative Learning
Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach
Y Team Teaching

4.0 Description of Activity [*activity*]

This social studies unit covers the economic advantages and disadvantages of Africa and relates them to the geographic location and climate of that country. Before class, K.J. created three worksheets/template, in MacDraw for the students to fill out during class time and posted them on the network for students to access. When we observed the students, they were logging on to the network using MacJanet, down loading the templates K.J. had created, and referring to their text books to fill in the blanks on the electronic worksheets using MacDraw. Students were also instructed to draw a climate map of Africa and label the geographic regions as they were listed in their textbook. This seemed to be a very traditional style of teacher and textbook directed teaching with the only difference being that the worksheets were on the computer. Students were given one week to complete all of these worksheets and were free to work on the assignment outside of class time as well. The class periods we observed were 50 minutes in length.

The following week's lessons would focus on helping students make the connections between the map, the charts, and the country's economy. These exercises were intended to help students understand the broader concept of how geography relates to all aspects of social studies. The general purpose of the activity was for students to use reference materials to process information and to present information in different ways with grids, graphs, maps, etc. This lesson relates to their overall curriculum goals by helping students understand how geography impacts where people live and why they live in certain regions. Secondly, it helps students focus on people, how people live, and how they produce and work. This was a 2 week unit.

5.0 Technologies Involved [*types*]: *Check off technologies used.*

N Microcomputers
Y Word processing
N ILS
N Spreadsheet
Y Other LANs
N Hypermedia
N WANs
N Animation
N CD-ROM
N Simulation
N Interactive videodisc
N Videocams and editing equipment
Y Other (Drawing program)

I checked word processing here because for some of the worksheets, students were using only the text tools in MacDraw to write information about the kingdoms of Africa.

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses [***kiduse***]

Tutorial ***[tutor]***
Because students were simply instructed to "fill in the blanks" using their textbooks, this seemed to be a very traditional style of teacher and textbook directed teaching with the only difference being that the worksheets were on the computer. The teacher was using the textbook to transmit information to the students, and students mostly worked on their own.

Exploratory ***[explore]***
No evidence of this.

Communication ***[commtn]***
Students used the communications software called MacJanet to access their electronic worksheets, to store their work, and to turn in assignments.

Students in this class use modems and communication software for local area networks. MacJanet is the communications software package used at the school site for teachers and students to communicate with each other via Ethernet (i.e., a hard-wire connection not using phone lines). All of the Macintosh computers in the 4 ACOT classrooms at West are connected via an Ethernet connection and are equipped with MacJanet software. Teachers and students have their own private storage space on the network where they can store their work.

Students use the network from home or on site to turn in assignments for their classes rather than handing in paper copies. Teachers also post the assignments on the network for students to download at their leisure. "There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class. Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Students have access to public programs on the file servers requiring less disks to be carried by the students" (from one the West ACOT handouts called "Apple Classroom of Tomorrow: Networks in Education?"). With this network, students also have the opportunity to work on any of their assignments from other classes from any computer. For example, if a student is in social studies class and has already finished the assignments for that class, she can log on to the server with MacJanet and work on an assignment for another class which she may not have completed.

Tool ***[tool]***

One could possibly consider this activity to be one where students used a tool (MacDraw) for data storage. In other words, students did use the drawing program to store bits of information about Africa. However, because the information students were entering into the electronic worksheets was primarily from their textbooks, this activity seems to be more "tutorial" than "tool-like."

- Teacher Uses **[*tchuse*]**

Communication

The teacher used the communications software called MacJanet to post electronic worksheets for the students to access. This network is also used for teachers to collect any assignments students have completed.

> LOCAL AREA NETWORKS
> MacJanet is a communications software package used at the school site for teachers to communicate with each other and their students via Ethernet (i.e., a hard-wire connection not using phone lines). All of the Macintosh computers in the 4 ACOT classrooms at West are connected via an Ethernet connection and are equipped with MacJanet software. Teachers and students have their own private storage space on the network where they can store their work. Teachers use the network to post assignments for their classes rather than handing out paper copies.
>
> "Now, these materials can be distributed within one minute to all students [rather than the teacher having to take 20 minutes from his/her lunch break to make copies]. There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class.

Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Teachers can collect materials at their convenience rather than taking away valuable learning time while with the students.

Teachers are able to cover the curriculum at a faster pace. For example, the Junior English teacher can send a document that needs corrections to the class. Within one minute, the students can call up the document, correct the grammar, spelling syntax, make revisions and then send the assignment back to the teacher without the use of paper. To do this in a conventional setting, the teacher would spend 20-30 minutes making a hard copy to pass out to the class. Students would then have to take the time to retype the entire document with corrections" (from one the East ACOT handouts called "Apple Classroom of Tomorrow: Networks in Education?").

Presentation
No evidence of this.

Instructional Management
No evidence of this.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration
  Students were instructed to works on their assignments independently. However, the teacher acknowledged that even with independent groupings, students often work collaboratively and help each other with their assignments.

- Independent exploration
  No evidence of this. Although students did work independently, the only exploration they seemed to be doing was with the textbook - they were searching through the text for correct answers to the worksheets they were given.

- Access to outside information resources
  No evidence of this.

- Support for higher-level thinking
  Students learn that information can be organized in many different ways with MacDraw, which may have an impact on how they make connections between the economics and geography of Africa. In other words, they should be able to understand how the information on one worksheet (e.g., different features of the each country in Africa) relates to the information on another worksheet (e.g., the economic advantages and disadvantages of the entire continent of Africa.)

- Creativity
  Students were able to choose which software to use to draw their map of Africa. (However, the obvious choice was to use a drawing program.)

- Technology skills
  Students learn that information can be organized in many different ways with MacDraw software. (However, the worksheets were organized by their teacher.)

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***
  Although students were not unmotivated with this activity, they were also not incredibly excited about doing it. I did not notice any outstanding signs of students being highly motivated, or unmotivated.

- Attendance, time on task, discipline ***[kidbehav]***
  Students seemed to be focused on their assignments and were very well behaved. There were no discipline problems, class attendance was high, and the noise level in the classroom was low because students were very busy. The teacher informed me that there is a lower absentee rate in the ACOT program in general than in the rest of the school.

  In a study conducted by Apple computer, researchers found the following statistics out of 232 seniors where ACOT students were randomly selected.

	East City High Students (non-ACOT)	East City High ACOT Students
Dropout rates	30%	0%
College Bound	15%	90%
Full Scholarships	6%	33%

- Amount of collaboration & cooperative learning skills ***[cooplg]***
  The fact that students are allowed to move about the room as needed - creates a general atmosphere of collaboration. Although students were told to work independently on this assignment, they would often help each other when technical problems arise or when one of their peers asked for assistance on part of the assignment.

- Ability to manage own learning ***[selfreg]***
  They were given one week to complete the worksheets and could work at their own pace. One student mentioned that he likes the fact that the teacher posts the students' grades in the classroom by the student's name or ID number because "teachers don't keep it a mystery" and students always know how they're doing. Also, if they get bad grades, other students tease them which makes them want to work harder to do better.

- Access to outside information resources ***[outinfo]***
  No evidence of this.

- Support for higher-level thinking ***[higher]***
  Students learn that information can be organized in many different ways with MacDraw, which may have an impact on how they make connections between the economics and geography of Africa. In other words, they should be able to understand how the information on one worksheet (e.g., different features of the each country in Africa) relates to the information on another worksheet (e.g., the economic advantages and disadvantages of the entire continent of Africa). One student told me he likes using the computer for school work because "you go deeper into the book. You review it more and learn the material more."

- Complexity of task students can accomplish ***[taskacc]***
  No evidence of this.

- Learning on specific tasks ***[kidlearn]***
  No evidence of this.

- Creativity ***[create]***
  Students were able to choose which software to use to draw their map of Africa. (However, the obvious choice was to use a drawing program.)

- Greater attention to how a product will be understood by others ***[audience]***
  No evidence of this.

- Technology skills ***[hackskl]***
  Students learn that information can be organized in many different ways with MacDraw software. However, the worksheets were organized by their teacher.

  Students also learn that they can complete assignments faster using technology than not using technology. One student who had procrastinated and waited until the last day to begin her map of Africa was able to draw the entire map in one class period. Several students mentioned that they preferred using computers to writing things out by hand because it was faster and neater on the computer.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	Reproduction and Evolution
Teacher:	S.B.
Site:	East City High School ACOT Program

1.0 Summary [*sum*]

At the time of our observation, S.B.'s 10th grade biology class was in the middle of a unit on the diversity of living things. His students were using HyperCard to take notes. They created these HyperCard stacks at the beginning of the year and are continuously updating them throughout the year. In the process of their note taking, they used HyperCard to create an animation of the evolution of the world and simulated how long the process took by using a much smaller time scale - one minute was set equal to 30,000 years.

2.0 Classroom Context [*context*]

The classroom layout consists of several rows of student tables (4 in each row) in the center of the room along with 2 round tables. These are mainly used for non-computer activities. There are also computer tables against all four walls where students gather to do their computer work. Equipment in this classroom includes the following: 2 MIDI keyboards, 9 Macintosh II computers (II's, IIcx's and IIx's), 5 Macintosh Quadra computers (2 of them with built-in CD-ROM drives), 2 laser printers, 1 modem, 2 CD-ROM drives, an overhead projector with an LCD panel, video camera equipment, and televisions, VRCs, 8 mm decks, and laser disc players for video editing purposes.

This classroom, along with all of the ACOT classrooms, are used interchangeably by all of the ACOT teachers and students in grades 9 through 12. On a weekly basis, teachers plan out which classrooms will be used for each of their classes, depending on what projects are currently going on.

The mode of instruction for S.B.'s biology class varies depending on the activity they are working on. When we observed his class, he was in the front of the room giving students instructions on the HyperCard stack he wanted them to construct and lecturing on the day's lesson. Students then worked together in groups of three at the computer on the assignment he handed out to them. FF. is the team teacher working with S.B. and was present in the classroom during the lesson to help students whenever needed.

S.B. has a total of 23 years teaching experience. Before becoming one of the original ACOT teachers, he taught for 8 years in the vocational education program at West. "He is a self-taught computer user and a leader in developing new strategies in the classroom. He has become one of the nation's leading experts on HyperCard and in the creation of innovative applications of technology in science teaching." (from a document called "Technology Enriched Schools," p. 61). When asked to describe his role as a member of the ACOT staff, S.B. described himself as the person on the team that is "constantly pushing change" and as someone who does not want to be caught in a routine because he feels many students do not benefit from routine teaching methods. S.B. is also the girls' volleyball coach for the high school and feels that his techniques in coaching spill over into his teaching.

FF. is S.B.'s team teacher and joined the ACOT team in its second year. She has a total of 20 years teaching experience and has been teaching at East City High School for 14 of those years. FF. completed her student teaching at East City High School and entered the ACOT program with limited computer experience. Like S.B., FF. has always been very willing to try new teaching methods and was very interested in innovations in the classroom.

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

Y Interdisciplinary
N Project-based
Y Collaborative Learning
N Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach
Y Team Teaching

Interdisciplinary - This course is integrated with math and physics.

The extended activity is the students' creation of their HyperCard notebooks which are continuously updated throughout the year for this course.

4.0 Description of Activity [*activity*]

The activity students were working on a during our classroom observation had to do with evolution. Students were instructed to work in groups of two or three to create a HyperCard stack that represented the passing of billions of years. They were to enter S.B.'s pre-written program into a HyperCard script which made computer run a series of numbers. The program instructed the computer to count the number of years it took for the earth to evolve by using one second to represent 30,000 years. After running the program, students went back to their seats for the rest of the lecture.

S.B. then explained the next part of the project they were to complete which entailed creating a HyperCard depicting and animating the Big Bang explosion. Students were receiving instructions on what the sequence of events to be included in their stack - an explosion, darkness, a picture of the earth, life forms at 1.2 billion years, first fish at .5 billion years, the first land plant at .475 billion, etc. and were to end with the first recorded history 5,000 years ago.

The purpose of the lesson, as described by S.B., is for students to understand the process of evolution by looking at all of the pieces separately and then how they fit together. He ties this lesson to the diversity of living things, reproduction, and DNA to help them understand the overall process of reproduction and evolution. He would like students to understand that changes in DNA structures and small mutations take millions of years to occur. This lesson will be followed by a lesson on dinosaurs - how they evolved, when they existed, how they lived and why they are not alive today. One of his overall goals is for students to understand which life forms have survived over which periods of time, which will survive tomorrow, and why.

When asked how this unit ties into his overall curriculum goals, he responded by saying he hopes students' problem-solving experiences with this lesson will transfer over to new situations and that they will make the connections between this unit and other things in their lives.

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y	Microcomputers
N	Word processing
N	ILS
N	Spreadsheet
Y	Other LANs
Y	Hypermedia
N	WANs
Y	Animation
N	CD-ROM
Y	Simulation
N	Interactive videodisc
N	Videocams and editing equipment
N	Other

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses **[*kiduse*]**

  Tutorial ***[tutor]***

  S.B.'s telling the students exactly how to program HyperCard so that it would count the number of years it took for the earth to evolve could be considered a tutorial exercise. He was transmitting this information to the students and gave them a copy of the program he wanted them to type into HyperCard for the simulation to run.

  Exploratory ***[explore]***

  No concrete evidence of this, although S.B. did mention this as a curriculum goal.

  Communication ***[commtn]***

  Students use the communications software called MacJanet to access their own private student files, to store their work, and to turn in assignments.

  Students in this class have access to modems and communication software for local area networks. MacJanet is the communications software package used at the school site for teachers and students to communicate with each other via Ethernet (i.e. a hard wire connection not using phone lines). All of the

Macintosh computers in the 4 ACOT classrooms at West are connected via an Ethernet connection and are equipped with MacJanet software. Teachers and students have their own private storage space on the network where they can store their work.

Students use the network from home or on site to turn in assignments for their classes rather than handing in paper copies. Teachers also post the assignments on the network for students to download at their leisure. "There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class. Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Students have access to public programs on the file servers requiring less disks to be carried by the students." (from one the East ACOT handouts called "Apple Classroom of Tomorrow: Networks in Education?") With this network, students also have the opportunity to work on any of their assignments from other classes from any computer. For example, if a student is in social studies class and has already finished the assignments for that class, she can log on to the server with MacJanet and work on an assignment for another class which she may not have completed.

Tool ***[tool]***

S.B. had his students use HyperCard to create an animation of the Big Bang explosion and to create a simulation of the time that passed from the evolution of the world to present day.

- Teacher Uses [***tchuse***]

  Communication

  The teacher used the communications software called MacJanet to post electronic worksheets for the students to access. This network is also used for teachers to collect any assignments students have completed.

  LOCAL AREA NETWORKS

  MacJanet is a communications software package used at the school site for teachers to communicate with each other and their students via Ethernet (i.e. a hard wire connection non using phone lines). All of the Macintosh computers in the 4 ACOT classrooms at West are connected via an Ethernet connection and are equipped with MacJanet software. Teachers and students have their own private storage space on the network where they can store their work. Teachers use the network to post assignments for their classes rather than handing out paper copies.

"Now, these materials can be distributed within one minute to all students [rather than the teacher having to take 20 minutes from his/her lunch break to make copies]. There is no waste of paper, and students know that if they are absent, they have immediate access to look up materials on the network without the need to stop the teacher from instruction to the rest of the class.

Students can mail in assignments on the network. Items are dated and time stamped when they are turned in. Teachers can collect materials at their convenience rather than taking away valuable learning time while with the students.

Teachers are able to cover the curriculum at a faster pace. For example, the Junior English teacher can send a document that needs corrections to the class. Within one minute, the students can call up the document, correct the grammar, spelling syntax, make revisions and then send the assignment back to the teacher without the use of paper. To do this in a conventional setting, the teacher would spend 20-30 minutes making a hard copy to pass out to the class. Students would then have to take the time to retype the entire document with corrections." (from one the East ACOT handouts called "Apple Classroom of Tomorrow: Networks in Education?")

Presentation
No evidence of this for this particular activity.

Instructional Management
S.B. uses a HyperCard stack to outline and illustrate his lesson plans. As the lesson progresses, he simply adds more cards to the stack as needed. He also uses some sort of program (??? maybe Excel ???) to keep track of his students' grades and homework assignments.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration
  S.B. asked his students to work collaboratively in groups of two or three to type in the HyperCard program he had written for the computer to count the number of years it took for the earth to evolve.

- Independent exploration
  Although I saw no concrete evidence of this, S.B. mentioned that students are given the opportunity to experiment with the technology (mainly HyperCard in this class) and to discover different ways they can accomplish the same task. For example, students independently created animations using HyperCard and discovered that different methods could be used to make objects on the screen appear to move.

- Access to outside information resources
  No evidence of this.

- Support for higher-level thinking
  The purpose of the lesson, as described by S.B., is for students to understand the process of evolution by looking at all of the pieces separately and then how they fit together. He ties this lesson to the diversity of living things, reproduction, and DNA to help them understand the overall process of reproduction and evolution and incorporates technology into the process because it gives students "multiple ways of solving problems." S.B. hopes students' problem-solving experiences with this lesson will transfer over to new situations and that they will make the connections between this unit and other things in their lives.

  Students develop higher-level thinking skills when they use HyperCard to create animation (i.e. an explosion with a large flash), to create a sequence of events (i.e. when different life forms came into existence), and to create a simulation (i.e. writing a script so telling the computer to display a series of numbers representing how long it took for the earth to be created). These activities involve not only understanding how the software works, but also require students to think about how to organize the information so that it will be understood by others.

- Creativity
  HyperCard allows students to be creative because of the nature of the medium and the freedom they are given in the assignments. By allowing students to create their own version of how the earth was created, and how and when different life forms appear, students are given the opportunity to express themselves and to be creative in their own way. Although students are given the same assignment, they are able to complete the assignment using whichever method they choose.

- Technology skills
  In this class, students learn how to use HyperCard, a hypermedia application, to create an animation (i.e. they were asked to use create the effect of an explosion with a large flash on HyperCard), to create a sequence of events (i.e. students were instructed to use cards to depict when different life forms came into existence), and to create a simulation (i.e. the learn how to program a HyperCard script so that the computer will display a series of numbers representing how long it took for the earth to be created). These activities involve understanding how to create buttons and cards, how to use the drawing and paint tools, and how to use HyperCard to tell a story.

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***
  S.B. mentioned that the technology is a "confidence-building factor that we never got before." Students were not as motivated to do their school work without the technology. The technology builds confidence in the students, excites them and motivates them to complete their assignments. Students openly talk about how much more excited they are about school because they are allowed to use computers and other tools which are valued in society. They know they are learning marketable skills that can be put to use in college an in the workplace.

- Attendance, time on task, discipline ***[kidbehav]***

  Student dropout rates for East City High School ACOT students have dropped dramatically. In a study conducted by Apple computer, researchers found the following statistics out of 232 seniors where ACOT students were randomly selected.

	East City High Students (non-ACOT)	East City High ACOT Students
Dropout rates	30%	0%
College Bound	15%	90%
Full Scholarships	6%	33%

  In his course description for the students, S.B. also stresses the importance of class attendance and of being on time to class and penalizes students for unexcused absences and tardiness.

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  The fact that students are allowed to move about the room as needed, even when they are working independently - helps reinforce the general atmosphere of collaboration. Students were asked to work in groups for this activity which facilitated their helping each other with technical problems or when another group of students asked for assistance on part of the assignment.

- Ability to manage own learning ***[selfreg]***

  As part of this class, students are required to keep a HyperCard stack of all of their notes for the class which accounts for 10% of their final grade. The teacher also demands that students turn in all assignments on time - those that are late receive only partial credit.

  Students are also responsible for keeping track of their work on the network and are given private space on the network for their assignments. They have a password so they alone can access their files.

- Access to outside information resources ***[outinfo]***

  No evidence of this.

- Support for higher-level thinking ***[higher]***
  Students develop higher-level thinking skills when they use HyperCard to create animation (i.e. an explosion with a large flash), to create a sequence of events (i.e. when different life forms came into existence), and to create a simulation (i.e. writing a script so telling the computer to display a series of numbers representing how long it took for the earth to be created). These activities involve not only understanding how the software works, but also require students to think about how to organize the information so that it will be understood by others.

- Complexity of task students can accomplish ***[taskacc]***
  Developing a HyperCard stack on the evolution of the earth is in itself a highly complex task. They were asked to use HyperCard to create animation (i.e. an explosion with a large flash), to create a sequence of events (i.e. when different life forms came into existence), and to create a simulation (i.e. writing a script so telling the computer to display a series of numbers representing how long it took for the earth to be created). These activities involve not only understanding how the software works, but also require students to think about how to organize the information so that it will be understood by others.

  Students are able to accomplish this task with the technology because of the training, support and guidance they receive from the teachers and from their peers.

- Learning on specific tasks ***[kidlearn]***
  Students learn how to use HyperCard which involves learning how to understand HyperTalk (the scripting language), how to create cards, buttons, and fields, how to connect the cards in a sequence, how to use HyperCard for animation, and how to use HyperCard to represent and illustrate their ideas.

- Creativity ***[create]***
  HyperCard allows students to be creative because of the nature of the medium and the freedom they are given in the assignments. By allowing students to

create their own version of how the earth was created, and how and when different life forms appear, students are given the opportunity to express themselves and to be creative in their own way. Although students are given the same assignment, they are able to complete the assignment using whichever method they choose.

- Greater attention to how a product will be understood by others ***[audience]***
  Students develop higher-level thinking skills when they use HyperCard to create animation (i.e. an explosion with a large flash), to create a sequence of events (i.e. when different life forms came into existence), and to create a simulation (i.e. writing a script so telling the computer to display a series of numbers representing how long it took for the earth to be created). These activities involve not only understanding how the software works, but also require students to think about how to organize the information so that it will be understood by others.

- Technology skills ***[hackskl]***
  In this class, students learn how to use HyperCard, a hypermedia application, to create an animation (i.e. they were asked to use create the effect of an explosion with a large flash on HyperCard), to create a sequence of events (i.e. students were instructed to use cards to depict when different life forms came into existence), and to create a simulation (i.e. the learn how to program a HyperCard script so that the computer will display a series of numbers representing how long it took for the earth to be created). These activities involve understanding how to create buttons and cards, how to use the drawing and paint tools, and how to use HyperCard to tell a story. Students also learn how to understand HyperTalk, HyperCard's scripting language.

JOHN WESLEY ELEMENTARY SCHOOL DEBRIEFING

Site: John Wesley Elementary School

Contact: L.M., Project Coordinator

1.0 Summary *[sum]*

John Wesley Elementary School is noteworthy for the extent to which it has implemented site-based management and teacher decision-making. Serving a population of students who are predominantly Latino, half of whom do not speak English, the school has grappled with the issues of how to create a learning environment that will support its students' acquisition of critical thinking skills and of literacy in two languages. The staff have worked together to write a variety of grant proposals to support their school reform efforts and have been very successful in obtaining funding in this way. When the school developed teams to study key issues for improving their school, technology emerged as an important potential tool. Computer resources are allocated to individual classrooms rather than a computer lab. A mobile lab of Macintoshes supplements the computers in any one classroom. Teachers have been allowed to proceed at their own pace with technology use. Some have developed creative projects capitalizing upon the available technology; others are just starting to feel comfortable with having their students use word processing for writing.

2.0 Context and Reform Overview

2.1 Educational Context *[context]*

Setting. Once surrounded by open fields, John Wesley is now bounded by residential housing built in 1992-94. The older areas surrounding the school are noted for their high crime rate, drug problems, and gangs. Located in a rural area in a western agricultural region, the school serves children from poor homes, many with parents who are migrant farm workers. One-third qualify for migrant education. More than 95% of the students have Spanish as their primary language, and 64% have limited proficiency in English. According to the school's recent self-study, about half of their students arrive from Mexico with little or no formal education (Self Study, p. 4, 1992). The classrooms are housed in multiple buildings of the "indefinite temporary" variety. Notices and posters appear in English and Spanish.

Grade levels. John Wesley serves around 800 students in grades K-6. Enrollment has fluctuated from around 790 to 840 because many students are children of migrant workers who move during the year (many spending November - March working fields in a southwestern state). More recently, families are staying in the area to maintain their housing while fathers follow the crops.

2.2 Demographic Information *[demo]*

Applicable unit: [✓ School] Class Project District Other:
Number of certified teachers (FTE): 30 regular + 4 resource
Enrollment as of 9/93: 840
Number or percent free or reduced lunch: 100% in 1992 and 1993
Number or percent LEP or NEP: 64%
Number or percent special education: 10%
Ethnic Composition *(Number or percent in each category)*

2%	86%	4%
African American	Hispanic	Caucasian, Non-Hispanic
1%	7%	
Native American	Asian/Pacific Islander	Other

Estimated percent students w/ computers in home: .02%

2.3 Education Indicators *[stats]*

Although serving a somewhat poorer population in terms of student SES, John Wesley is considered similar to six of the seven other schools in the district (the exception being a new school serving the children of high-tech professionals who have started to enter this area) by the district. The school has a reputation for having an energetic, capable staff, but does not stand out from the district profile in terms of student indicators, such as standardized test scores.

2.4 Reform History *[reform]*

- Nature and when started ***[history]***

John Wesley opened in December of 1981 with what the district administrator described as an "enthusiastic corps of teachers" that included teachers "with the ability to take a leadership role." In 1988 two of the schools (John Wesley and one other) in the district were given the opportunity to participate in a science improvement program, promoting thematic instruction around science topics, funded by the Packard Foundation. In 1989 all schools were invited to participate. Requirements for funding included having 1/3 of the teachers commit to active participation and the other teachers agree not to undercut the effort toward change. The program provides participating teachers with 2 weeks of summer training, the first devoted to curriculum development and the second to working on teaching strategies with model teachers. In 1988 through 1991 each teacher received $500 for the purchase of science materials and got 3 to 4 days a month of coaching from an outside peer coach. Beginning in 1992, John Wesley allocated $300 to each teacher from within its own budget. The program emphasizes the concepts of integrated thematic instruction (ITI) and "brain compatible learning." It involves having individual teachers develop interdisciplinary units around major themes with science content (e.g., whales), using a student-centered approach, and getting away from textbooks. "Pedagogical and curricular approaches engage students in learning experiences that provide hands-on, problem-solving activities, and that create rich linkages to writing and literacy through the use of first-hand experiences as a basis for the development of writing and literacy skills." (p. 2, SB 1274 proposal). Eight more John Wesley teachers signed on in the second year, and participation has continued with 79% of teachers trained by spring of 1993. Ten John Wesley teachers became science improvement program coaches for other schools. As foundation funding tapered off in the grant's fifth year, the school chose to maintain the 2 days of outside coaching per month by spending money obtained through other grants (SB1274 and Eisenhower). The school has sought out other teacher development opportunities, such as 5 days of inservice training on cooperative learning taken by 22 of the regular classroom teachers (sponsored by Johnson & Johnson).

Another major impetus for reform activity came in the fall of 1990 when the district superintendent made contact with the president of Telesis at a Business Roundtable meeting. The Telesis Foundation was looking for schools to work with in supporting education reform. The superintendent encouraged John Wesley to apply for funding and they were successful. The Telesis program initially emphasized site-based management. Participation required development of a site-based council and the principal's relinquishing of many decisions to that council and staff. The development of a detailed plan of where the school wants to be in 8 years was also part of the process. Telesis funded a number of professional development activities such as a corporate-style retreat. After a few years, the project changed its emphasis to focus more on assessment, and this is leading John Wesley to start working on portfolio assessment and continuous improvement in all areas of school program and management.

Another stimulus for school reform activity was receipt of a 1-year planning grant and then a 5-year school restructuring grant through SB 1274 (the state's school restructuring program). The proposal for their grant emphasized planning activities in four areas: ungraded classrooms, brain-compatible learning, increased hands-on life experiences, and parent education (p. 3). The proposal stated that staff would explore technology as an instrument for increasing hands-on learning and supporting brain-compatible learning. One of the goals John Wesley selected was the development of Individual Learning Paths for each student—to be developed jointly by students, teachers, parents, psychologists, and social service representatives. The proposal writing process has helped to keep staff focused on their goals for the school and makes them good at articulating them. When the state's fiscal crisis forced 50% cuts in the SB 1274 implementation grants in the first year, the staff were able to respond quickly with a prioritizing of the activities they had initially proposed.

John Wesley also applied for and received planning (1992-93) and implementation grants (starting in 1993) to become a Healthy Start site (school-based integrated family services). In 1993-94 the school began offering Head Start services, with children meeting in a local church facility until the Head Start building could be completed (will open in fall of 1994).

By 1994, about half of the teachers were using portfolio assessment in some areas of the curriculum. The project coordinator also serves as head of the district's assessment task force. She is urging John Wesley teachers to use portfolios for writing assessment. All students save works in progress in a working portfolio. The plan is to also have a showcase portfolio for selected finished products. The student and teacher would select three exemplary products to demonstrate particular outcomes (which have been developed for each grade level; copy in John Wesley case file). The project coordinator hopes to develop a performance-based assessment for administration each fall and spring. She believes that once these assessment approaches get worked out for writing, other content areas will follow. The teachers had plans to develop software to support portfolio development, but in the spring of 1994 the project coordinator reported that this effort didn't get too far. The software seemed too generic to be helpful. The project coordinator and five John Wesley teachers participated in a state K-4 learning assessment program, looking at assessment in relation to the learning assessment tests. The project coordinator characterizes the state task force as a pioneering group that may become "the beginning of a statewide authentic assessment project, similar to what Vermont has done." Participation included spending 2 days in the state capital with educators from throughout the state, all trying to relate student work from portfolios to the learning assessment rubric, seeking to identify what was missing and how it was tied to portfolio assessment. Two members of the collaborative from another district have developed software for portfolio assessment in reading and writing; the project coordinator expects to get a copy of this software this summer so that she can review its potential for use at John Wesley.

During 1993-94 John Wesley conducted an extensive self assessment, required by Telesis for schools in its program. The assessment covered the areas of information and analysis, student achievement, leadership, quality planning, professional development and management, continuous improvement and evaluation, and partnership development. The resulting 200-page report contains narratives, quantitative data, and survey results related to many aspects of restructuring (report available in case study file). Another round of assessment will be conducted in 1994-95.

- Reform Features ***[feature]*** (check all that apply)

X Nongraded groupings
Extended periods
X Schoolwide themes
X Teacher professionalization
X Authentic assessment
X Use of outside resources

- Key Individuals ***[key]***

While John Wesley benefits from the presence of quite a few strong teachers, the key individual seems to be the project coordinator, one of the original John Wesley teachers who was elected by the teachers to serve as Project Coordinator for the Telesis Initiative. She was also instrumental in writing many of the other proposals, and coordinates these efforts with the district offices. The principal has been willing to go along with innovations, making what he himself described as a difficult transition from making decisions himself to being able to give teachers responsibility for making decisions: *"I was afraid to lose control of the staff. I worried that if I delegated too much things wouldn't get done"* (Self Study, p. 51). Over the years, however, he has become comfortable with the role of facilitator: *"If I come up with an idea that is good for the child then I plant the seed within the group and they discuss it. I don't just make the decision to do it. The group has to make that decision after they've researched it and talked about it among themselves"* (p. 52). The district interviewee also gives credit to the district superintendent, who made the initial contact with Telesis and who has been supportive of reform activities in the district generally.

- Funding sources for reform **[*funds*]**
  In addition to regular state and local funds, John Wesley obtained funding for reform activities from foundation (Packard) and business (Telesis Foundation as well as a local seed company) sources and from state grant competitions (for school restructuring and integrated family services programs).

  State school restructuring (SB 1274) funding has been $30K in 1991-92 for planning; $75K for 1992-93; $149K for 1993-94. There are 3 more years to go on the demonstration grant. Telesis funding has provided $250K over a 4-year period. The county science improvement program provides $6,000 for each of the 10 teachers trained as science improvement program coaches. Healthy Start funding has been $300K over a 3-year period. The school has also received small Life Lab grants from private foundations and business.

- District involvement/support **[*localref*]**
  The district has supported John Wesley in putting them in touch with potential funding sources (Telesis Foundation), supporting their proposal preparation efforts, and giving them permission for innovations, such as using the funds previously allocated for a vice principal to pay for a part-time counselor and a 40% time parent coordinator. The district put up $600 for each teacher participating in the science improvement program (the foundation paying another $3,000). The district also allowed schools to take the maximum of 8 staff development days and moved from districtwide to site-specific staff development activities for these days. Authentic assessment also has been a districtwide initiative since SY 1990-91. From the school perspective, on the other hand, the district has sometimes been reluctant to allow John Wesley to be different. (The project coordinator explains that this was true originally—John Wesley was 2 years ahead of the game and "hit the wall," but now the district and school are in synch and things are running smoothly.) The

example given was John Wesley's desire to hire four parents to replace teachers in doing yard duty; it took nearly a year to get the district's OK for this action. Even so, this district is one that supports innovation generally. Five of the seven schools in the district received state planning grants for restructuring and four received implementation grants. The district supports activities that "move to a student-centered curriculum, get away from the textbook, support students in the affective domain, and manage the day in new and more effective ways." In 1992-93 one district administrator "adopted" each school, attending staff meetings and site council meetings when restructuring is discussed.

- State/federal involvement/support **[*stateref*]**
  The state program of providing planning and implementation grants for restructuring (SB 1274) gave John Wesley both dollars ($30K in 1991-92; $75K in 1992-93; $149K for 1993-94; 3 more years of funding to go) and a state-level mandate to develop their vision of where they want to be. In John Wesley's case, the state program was not pivotal; the school staff was already well along the path toward restructuring, spurred on by activities connected with the science improvement program and Telesis grants. An additional state grants program, Healthy Start, gave John Wesley the funding ($300K) and impetus to implement a specific piece of their vision—site-based family services.

- Role of tech in reform efforts **[*techref*]**

	Part of initial reform concept
X	Emerging part of reform efforts
	Parallel effort

John Wesley's efforts at change did not start out with the idea that technology was key; this idea emerged during the deliberations of the teacher committees set up to implement the restructuring plans. In terms of technology implementation per se, John Wesley is somewhat ahead of other schools in the district but not dramatically so. The school is noteworthy for the way in which technology use is integrated with an overall education reform philosophy rather that for the amount or sophistication of technology use per se.

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*]

In developing their proposal for a school restructuring grant, teachers began to think about the potential of technology to support hands-on learning and the kind of critical thinking and problem-solving skills addressed in the "brain-compatible learning" approaches they were trying to implement in their classrooms. They saw advantages also in the ability of the computer to adapt to the learning pace of individual students. In their recent self study, the teachers cite also the contribution of technology to collaborative learning and invoke a vision of students and teachers using telecommunications.

3.2 When & How Application Started [*how*]

One of the teacher teams set up as part of the school restructuring effort focused on the potential of technology to support the school's goals. One of the resource room teachers was accustomed to using computer software with special education students and he became a facilitator and advocate. Technology was made a part also of the school's proposal to the state for a restructuring grant. The school began using grant money to acquire equipment.

3.3 Technologies Used [types]

Microcomputers (40 Mac LCs, 37 Duo Docks, 23 Apple IIgs, 22 Apple IIe's)
X Word processing
ILS
X Spreadsheet
X Other LANs
Hypermedia
X WANs
Animation
X CD-ROM
Simulation
X Interactive videodisc
X Videocams and editing equipment
Other (satellite dish)

3.4 Target Grades & Curricula [*levels, curric*]

John Wesley has not sought to limit technology use to certain grades or curricula. They have placed more computers in upper-level classes than in primary classes (in 1992 four versus one computer, in 1993-94 five versus three computers), but all teachers have access to the mobile Mac lab and multimedia center. In addition to using technology to support the school's general emphasis on thematic instruction with science content, teachers also use it in developing literacy skills and in mathematics and reading practice.

3.5 Key School Players [*infield*]

(Provide names, titles, and a description of roles)

The technology implementation is largely left to the teacher level. The project coordinator does not believe in forcing any innovation on teachers. Thus, those who are using technology are enthusiastic volunteers. They receive some help in choosing instructional software from one of the resource teachers. In 1993-94, with the donation of 37 Macintosh Duo Docks to the school, more teachers began using technology and the resource teacher provided an increased level of technology training. He also became a technology mentor teacher for the district. An in-house proposal to allow him to devote 1 day a week to providing technology support is pending. The district computer consultant provides training in areas such as how to hook up and operate equipment and specific software training.

3.6 Outside Players in Technology Application [*outfield*]

Discuss important players outside the school including:

- District involvement ***[distr]***

  The district has supported technology implementation in a number of ways. A district technology coordinator has provided training to teachers in how to use technology. The district has set up a technology committee to coordinate activities across schools (e.g., get site licenses for MECC software for each school). When schools in the district became schoolwide Chapter 1 sites, the district used Chapter 1 funds to buy Mac LCs for teachers' use as well as to pay for a technology trainer. (John Wesley received $50K.) Each school was given a multimedia center (laser disc player and 27" monitor; VCR; CD-ROM; overhead projector and two speakers), but implementation has been limited because of lack of software, the heaviness of the cart, and the lack of hands-on training (the district consultant showed interested teachers how to hook up the equipment but no one gave them training on instructional uses.) The district also purchased a satellite dish and large screen for each school as part of the multi-purpose rooms financed by passage of a bond issue. The dish receives little use at John Wesley, however.

In the SB 1274 proposal, the section written by the district actually says much more about technology than the section written by the school. "The District envisions using advanced technology to develop skills in students which apply to careers in this new [information-based] society....Through the use of technology within a local and international setting, the District seeks to assist the students in developing a strong sense of self which validates their rich, multicultural and linguistic heritage.... Families will have access to parent and family educational programs in Spanish from countries around the world as well as state programs." (un-numbered pages).

- State involvement ***[state]***
  State involvement has had more to do with education reform generally (and is described above) than with technology in particular. However, the state school restructuring grants program does encourage schools to consider the use of technology in their restructuring efforts. In 1993-94 John Wesley chose to use most of their SB 1274 funds to develop a LAN for their LCs and to obtain an Internet connection.

- Business involvement ***[bus]***
  The main business involvement has been through the Telesis Foundation Education for the Future grant initiative, which was very influential. Although this program was not designed with a technology focus, it led to the establishment of a Curriculum Action Team (of teachers and aides), and that team chose to make technology a priority. In addition, in the later phase of this grant, Telesis is working to support schools' authentic assessment efforts.

- Foundation involvement ***[foundtn]***
  As indicated above, involvement with the Packard Foundation's science improvement program was instrumental in getting John Wesley teachers energized to rethink what and how they were teaching. This activity provided the student learning needs framework for rethinking the school's structure and gave teachers skills in thematic project-based curricula and cooperative learning methods that made it easier to later introduce technology (see classroom examples).

- Parent involvement ***[parent]***
  Parents were not instigators for the introduction of technology. Very few have computers in their homes or use them in their work. When parents have come into the classroom and seen technology, they are impressed by it, but their initial reaction is that it is not for them. John Wesley is in the process of setting up a program to begin in 1994-95 for parents to come into the school in the evening and have access to computer equipment.

- Other outside influences, including research
  The teachers have been influenced by the educators who developed the handbook for the science improvement program. Howard Gardner's work on multiple intelligences is cited frequently also. In general, the education reform concepts stressed by the funding agencies (Packard, Telesis, and the state) have been adapted and internalized by many John Wesley teachers.

4.0 Overview of Tech Uses

4.1 Student Uses *[kiduse]*.

- Tutorial
  Instructional games are the second most common use of computers (after word processing). In classroom observations, we also saw tutorial programs for keyboarding skills in use. The multimedia lab is used slightly more often than last year, primarily for laser discs. One of John Wesley's teachers has recently become a Life Lab Mentor for the district,

and she makes active use of the laser disc player within this program. The satellite dish is not used, but the resource room teacher is currently looking into distant learning opportunities. He states that the reason for lack of use has to do with teachers' preferences and familiarity with cable (three educational stations are accessed). There are six televisions in the school, shared among the classrooms and used for programs such as the reading program and the county education presentations. Videotapes are used more than the cable.

- Exploratory
  Some of the classes have used exploratory software such as SimAnt during rotation and free-choice times. They have also used math/science software from MECC that allows students to manipulate and predict the speed of airplanes and cars (exploring factors such as slope of ramp, weight of car). These programs have supplemented the curriculum but not been integrated with it or central to core instruction.

- Communication
  Students have participated in NGS Kids Network, but network activities do not occur on a regular basis. One teacher reports having done some exploration of Internet resources.

- Tool
  The most common instructional use of technology is as a word processor, especially the Learning Company's Bilingual Writing Center. Sixth-grade life skills classes have used database applications and spreadsheets. The two classes described in separate debriefing forms were much farther along than other classes in terms of integrating technology into their overall curriculum. One teacher's class (described separately) has taken a "tools" approach to both computer and video technologies.

4.2 Teacher Uses *[tchuse].*

A resource room teacher reports that all of the teachers, since receiving Duo Docks, are using computers to prepare instructional materials. He estimates that 70% are using them to write narrative reports to parents and that 80 to

90% are using them for instruction with children. In most classrooms, computers are on at some point every week, but the level of access varies greatly. The LCs were connected to a LAN in 1993-94. The network is used for downloading software. An e-mail system will be used in the fall of 1994.

- Communication

  Since the introduction of the Duo Docks, an estimated 70% of teachers use the computer to write narrative reports to parents.

- Presentation

  A resource room teacher reports that all of the teachers, since receiving Duo Docks, are using computers to prepare instructional materials. Teachers are working in teams of two to four and use the Duo Docks to develop curriculum and graphics.

- Instructional Management

  Not used for this purpose at present, but there is a plan to install e-mail next year and then to add software permitting teachers to report attendance and lunch counts electronically.

5.0 Implementation Details

5.1 Problems Encountered *[probs]*.

- Difficulties in selecting hardware/software **[*pick*]**

  Yes. Hardware and software selection appears to be fairly ad hoc. One limitation is the scarcity of software available in Spanish as well as English. One of the resource teachers has an interest in instructional software and collects publishers' catalogs and provides advice to other teachers. Mostly, John Wesley teachers seem to be at the "well, let's try a little of this" stage. One teacher said she would like to find more computer-based "fun" things that give diagnostic information. Some of them are taking a "technology tool" approach, using word processing software, video cameras, and telecommunications (Kids Net). Lack of time for teachers to learn about and select software was cited as a specific problem.

- Difficulties obtaining hardware/software **[*get*]**
  Yes. The problem has not been inability to get something so much as lack of a well-developed plan to get all the components or software needed to make a piece of hardware really useful. For example, the multimedia centers were purchased for the schools with very little software (did have Nova Pathfinders and a few CD-ROMs). The cable for the satellite dish runs to the multi-purpose room, but not the classrooms, leading to underutilization of this resource. Lack of a satellite guide for the Pacific time zone was cited as another barrier.

- Difficulties maintaining systems **[*work*]**
  John Wesley has had difficulty with service and has lost some equipment (the agreement is with the county). Often the school needs troubleshooting support and one resource room teacher is frequently called from the classroom to troubleshoot the system. The school also has had network breakdowns. The server does not work for everyone and the school was able to call in for service in the past.

- Theft/vandalism **[*crime*]**
  Not a major problem, but Internet access was delayed when a connecting cable was cut by vandals who were stealing outdoor overhead lighting and cut the cable in the process.

- Teacher lack of knowledge/fear **[*block*]**
  Yes. One resource room teacher and another teacher report that the primary reason for nonuse is fear. Teachers are afraid that they will lose their work or that they will break the machines somehow, and they appear to have difficulty getting over this initial hurdle. Some teachers do not see the point of using a computer. (The resource room teacher observes that teachers with nice handwriting might not want to switch to word processing!) Initially, most teachers were limited in their familiarity with technology. Many took the basic literacy class offered by the district, however, and some of the teachers demonstrated a willingness to explore technology, even doing so in front of their students. Others,

especially at the primary level, remained timid. Duo Docks have had a tremendous positive impact on this aspect, as teachers are able to explore the technology at home.

- Lack of time for learning to use technology or developing technology-related curriculum units **[*notime*]**

Yes. The project coordinator feels that the lack of training and support for use of technology has been a major problem in the implementation and restructuring process. She estimates that most of the teachers are using the computers beyond instructional games, but use is still well below what could be done with the technology the school has. Few teachers sign up for the portable Mac lab. The multimedia center is rarely used. Primary teachers in particular appear to be afraid to use the computers. The Duo Docks have had a positive impact, giving teachers the opportunity to explore and become familiar with the technology at home and at their own pace. In addition, the required training component has increased technology skill and use.

The project coordinator: *"The portable Mac center is there, but not a lot of people use it. We've even thought about splitting those up...I think that elementary school teachers—it's like putting gas in the car, you put it in and you want it to run and you don't ever look under the hood. I think that it is the same with computers...we just haven't had the time, because of all the other things that have been going on, to do the training...the other thing that we have been talking about...is that we need someone like the ITI coach who, when computers break down, can be a troubleshooter..."* (Interview).

Teachers have not had the opportunity to observe others' instructional uses of technology. Grants have provided for some supported curriculum development time which could be used to develop units supported by technology (although this does not appear to have happened to any significant extent). In 1993-94, the teachers received a full-day session on use of the Duo Docks and a series of five after-school mini-training sessions on topics they had selected (e.g., Microsoft Works, Kid Pics, the Bilingual Writing Center).

- Disappointing results from using technology **[*letdown*]**
  No.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**
  Not mentioned.

- Lack of funds **[*nofunds*]**
  Not mentioned.

- Resentment from nonparticipating classes/schools **[*green*]**
  Somewhat. The project coordinator reports that the school's teachers have a reputation as "elitists" within the district. The school's success in attracting outside funds has contributed to this sense; apparently the receipt of the Duo Docks for all teachers cemented it. The resentment does not appear to have slowed down the school's efforts but it has probably slowed dissemination to other schools within the district.

- Lack of technical support **[*nohack*]**
  Limited technical support appears to have been a hindrance. One of the resource room teachers has a longer familiarity with computers and with educational software than other teachers and he has offered technical support as well as provided inservices as much as time permitted. However, he has limited time and is not an expert on some of the things the school would like to try (e.g., use of HyperCard or the Internet). The school is in need of a full-time technology support person.

- Failure to see fast positive effects on test scores **[*noshow*]**
  Not mentioned.

- Other **[*bug*]**
  Problems encountered with students accidentally crashing hard drives or trashing files have been eliminated through installation of a software program (At Ease) that does not allow access to the hard drive. Students can no longer save to the hard drive and instead store their work on their individual disks.

5.2 Strategies for Overcoming Barriers *[solve].*

- Inservice training/release time

  Eight people were trained for a full 2 weeks in ITI under the science improvement program grant in 1988; 70% participated in 5 days of training in cooperative learning. Since then, teachers work with a coach who comes twice a week. The staff is considering training two substitutes in ITI and using the substitutes consistently to avoid having to "go back to textbooks and dittos" when a teacher is out for training or illness. The resource teacher became active in 1993-94 in providing after-school mini-sessions on technology topics suggested in a teacher survey. There was no special funding for these activities.

- Involvement of outside experts

  The school has made some use of the district's technology consultant but has no extra outside technology resource.

- Creative fund raising

  The school has been quite successful in writing proposals both to the state and to private foundations.

- Other

  The introduction of the Duo Docks in 1993-94 (offered to teachers by Telesis in cooperation with Apple on the condition that teachers attend training sessions and use the computers in their classrooms as well as at home) has greatly increased the use of technology among teachers. Only one John Wesley teacher was reluctant to take up the offer (the computers become the property of the teachers if they keep their end of the bargain and remain at John Wesley for 5 years) and that teacher was won over by an invitation to "come in and play" with the system.

5.3 Facilitators *[facil].*

- Technical support on hardware/software ***[techta]***

  The district provided help in the form of a technology consultant who gives occasional inservices; in 1993-94 a more active program of inservice training was provided by a knowledgeable resource room teacher who also helps others informally.

- Teaching skills (nontechnology) ***[haveskl]***
  Teachers reported that the incorporation of a handful of computers was easy because students are used to working on different things and in small groups. The emphasis on collaborative learning and student projects in the science improvement program appears to have laid the groundwork for the introduction of technology-supported projects.

- Technical assistance on integrating technology into instruction ***[instrta]***

  Not provided.

- Supported time for teachers to develop skills ***[timesupp]***

  From 1988 to 1991 there was very little supported time for teachers to acquire skills in using technology. Since then, funds from SB1274 and the Telesis Foundation as well as the regular school budget have allowed for more supported time for technology training. This year (1993-94) after-school trainings on Duo Docks take place on a weekly basis. These sessions are well attended. A smaller number of teachers is selected to attend a more extensive district-sponsored training (2 days a month for 3 months). Twelve John Wesley teachers have participated this year. This training is offered as part of the district's 5-year technology plan. There are 7 inservice days per year at John Wesley.

- Other
  John Wesley's Tech Committee has recently completed a technology continuum that states what students should be doing with technology at each grade level. The project coordinator is hoping that this will give teachers the push that she feels is now needed to get them using the technology. The resource room teacher reports that the continuum, which now lists skills by grade, will be revised to be more outcome based.

5.4 Costs *[costs]* *(Estimates in dollars or person months)*

SB 1274 funding has been $30K in 1991-92 for planning; $75K for 1992-93; $149K for 1993-94. There are 3 more years to go on the demonstration grant. Telesis funding has provided $250K over a 4-year period. The project coordinator estimates the amount of grant funds spent on technology as $6K in 1990-91; $40K in 1991-92; $40K in 1992-93; and $15K in 1993-94. These figures do not include the value of donated hardware or district expenditures on technology for the school. The county science improvement program provides $6,000 for each of the 10 teachers trained as science improvement program coaches. Healthy Start funding has been $300K over a 3-year period. The school has also received small Life Lab grants from private foundations and business (but these have not involved technology use).

6.0 Impacts *[impact]*

6.1 Effects on Students [*kidout*].

- Motivation *[motiv]*
  A number of teachers reported that the computer made students more interested in writing. One said that before introducing computers it was hard to get a half page out of many of his sixth graders, who now "love to be glued to the computer." Kids will stay after school to write letters on the computer.

- Self-esteem *[kidestm]*
  One teacher commented that the idea that they have a technology skill makes students feel more comfortable; he hopes that this will give them an advantage when they move on to high school. He also noted that having a nice-looking finished product increases students' pride in their work. One primary teacher reported that copying text onto the computer makes her students more aware of capitalization, punctuation, spelling, etc.: "With a computer they want to do it correctly."

- Attendance, retention, disciplinary rates *[kidbehav]*
  The project coordinator reports that the attendance rate at John Wesley is very high ("99.9%"). She attributes this to the whole restructuring

effort, but is unable to prove this. Students ask to stay in to work with computers and treat the equipment with respect and care.

- Technology skills ***[hackskl]***

  The skills students acquire have varied with the particular teachers they have had, although there is likely to be more uniformity in the future as the schoolwide technology objectives take hold. Students in one fourth-grade class we observed had learned to use the computer for telecommunications, for writing, and with educational software. The teacher reported that the technical skills involved in using the computer to engage in these activities come naturally to children, especially when learned within the context of meaningful activities. She commented that there are students who know more about particular programs and computer functions than she does, and that students are often able to teach one another how to use the computer more effectively than she can. In a fifth-grade class, the teacher involved students in the process of figuring out how to use new hardware and software. Working together in small groups, they would walk their way through the manuals, learning by trial and error, and identifying links to both individual and group interests. Students were given responsibility for teaching other students to use the technology, in the process building on their own knowledge and skills. Students were encouraged to come up with their own approaches to incorporating new technologies into their work, both independently and within their groups. Specific technology-oriented concepts (e.g., the notion that computers provide access to outside resources) and skills (e.g., keyboarding) were stressed, but always in relation to an authentic task or purpose.

- Other
  One teacher said that through collaborative technology-enhanced projects students have learned to assess each others' skills (e.g., who is strong in developing ideas, writing, speaking) and make appropriate task assignments.

One teacher reported that technology has led to kids' developing their cooperative skills as they help each other on computer-based activities. One teacher reported that kids who would not speak to her in English would use English when working with a peer on an English-language computer activity.

6.2 Effects on Teachers [*tchout*].

- Inclination to assign complex tasks ***[hardtask]***
  One teacher reported introducing computers as one of his regular 20-minute stations but then finding that 20 minutes wasn't enough on the computer-based tasks; he then lengthened the rotations to 40 minutes.

- New instructional strategies ***[tchstrat]***
  The use of computers as writing tools has led to a different approach to writing. Students are writing collaboratively more often, and they are able to share their written products more readily. In many classrooms, students are creating their own books.

- Self-esteem and sense of professionalism ***[tchach]***
  Teachers have taken on a greater decision-making role and have input at all levels, including budgetary decisions. One teacher reported staying at this school because it provided so many opportunities for professional development.

- Communication with other teachers ***[tchtalk]***
  Teachers have had increased opportunities to interact with each other in the process of developing proposals and serving on the various committees created under the site-based management initiative. Some of the committees have petered out, but they did create channels for communication at least for some time. E-mail for teachers to communicate with each other is planned for next year.

- Use of their time ***[timeuse]***

  One teacher reported introducing computers as one of his regular 20-minute stations but then finding that 20 minutes wasn't enough on the computer-based tasks; he then lengthened the rotations to 40 minutes. The portable lab is used in special day class more often.

6.3 Effects on School Climate & Processes [*schout*]

- Increased linkages with outside organizations, resources ***[link]***

  Haven't analyzed. The school's activity in the area of authentic assessment have led to involvement with other teachers at both the district and state levels.

- Enhanced role as magnet ***[magnet]***

  No effects reported.

6.4 External Accountability Measures & Their Influence [*account*]

Test scores for this school population appear to be quite unstable. In 1991-92, their basic skills test scores were described as "the lowest in the district" after being the highest 2 years previously. The project coordinator was worried by the school's poor showing on the basic skills test in 1991-92. There did not appear to be any negative fallout from the low scores, however, as the district does not regard them as good measures of what the school is trying to do with its students. The district administrator interviewed said she was more interested in upcoming learning assessment scores. Old learning assessment scores for 1989-90 showed sixth graders doing well in their "comparison band" but still performing poorly on a statewide basis. The 1992-93 learning assessment results in reading were in line with districtwide results, which were low in comparison with the state. Results in mathematics compared favorably to the rest of the district, with 21% of the John Wesley students versus 55% of the students at the district level scoring at the lowest performance level and a higher percentage of students (16% versus 8%) demonstrating an "acceptable use of tools and techniques." Comparisons with state learning assessment results were less favorable (although the percentage of students scoring at the lowest level statewide was 38% as compared to John Wesley's 21%).

6.5 Evaluation [*eval*]

- Test scores

  Students are tested in English on the basic skills test and in Spanish on the Spanish basic skills test. Scores have fluctuated from year to year and grade to grade, generally ranging between the 35th and 50th percentiles in math and between the 30th and 45th in reading. The school's program is not targeted at improving scores on standardized tests. Nevertheless, the drop in scores in 1991-92 was a disappointment. In 1992-93 project coordinator reported that scores were better than expected. This is not a comparison point though since a new test was implemented. The school is actively involved in developing authentic assessments, but does not yet report any summary scores based on alternative assessment approaches.

- Retention rates

  Retention is treated carefully with students going to Child Study Group. The school is looking for other means of intervention. In 1992-93, there were a total of 5 children that were retained whereas in 1988 12-15 children were retained.

- Attendance

  The 1992-93 school report card stated that the attendance rate has been steadily improving over the last 3 years.

- Discipline rates

  Discipline rates and the number of students treated by the school nurse have dropped.

- Teacher turnover

  Teacher turnover was described as low.

7.0 Reflection and Advice

7.1 Dissemination [*spread*]

The principal was asked by the state university to be on a panel focusing on restructuring. An agency did a study of the school and has published material on John Wesley. The project coordinator sits on the K-4 learning assessment program at the state level and the assessment task force at the district level. One of the resource room teachers is a technology mentor teacher for the district, and has recently shared the technology continuum developed at John Wesley with other schools. The project coordinator feels that sharing between schools within the district is "the weak spoke in the wheel." The entire district is restructuring; there are four local schools that have received SB 1274 grants, yet there is little collaboration among the schools.

7.2 Plans [*plans*]

There are plans for gradual implementation of network-based activities. The groundwork was laid this year with the implementation of a local area network and the practice of having software downloaded to individual computers. Next year there are plans to have teachers start communicating with each other and the administration through the network. In addition, the district will be implementing a program to give schools access to the Internet.

7.3 Advice [*advice*]

The project coordinator focuses her advice on the interpersonal and managerial aspects of site-based governance: *"You really have to step out of your shoes and look at every single person on the staff and see how people react. Listen and try to look at the lens shooting back at you...like taking a video camera and getting down at the level of a 2-year-old...Unlearn some behaviors...The two mistakes that we have made in the last month (have to do with the fact) that we have reverted back to old management. Keep plugging along because it is slow. We are a far cry from where we were. The first retreat was like...we can't even work together, this is awful. Now there are no sparks...we always respect each other even if we disagree and we can walk in the next day and say, I still don't agree with you but..."* (Interview).

The district administrator advised that reforms need to happen at the school site but that they need to feel support from the district.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	C.C.'s 4th Grade: A County Science Improvement Program Classroom
Teacher:	C.C.
Site:	John Wesley Elementary School

1.0 Summary [*sum*]

This entry provides a snapshot view of technology use across the curriculum within C.C.'s 4th grade classroom. The curriculum is based upon a foundation-sponsored science improvement program that has been adopted by John Wesley School. It is a science-oriented, integrated thematic approach in which students engage in collaborative projects and activities related to central themes (e.g., the study of whales and marine life). Technology is used to support the curriculum in a variety of ways: e.g., as a writing tool, as a tutor, as a vehicle for telecommunications.

2.0 Classroom Context [*context*]

Teacher Background The 1992-93 school year is the teacher's 5th year at John Wesley. She has taught overseas, "at all levels" and including ESL. She commented that it was the opportunities for teacher development that kept her at John Wesley. "The only reason I stayed here is that they give you all this training, the tech training and the science training. They're not afraid to spend money on it and that's really a feather in our caps as teachers."

Throughout our interviews with C.C., she expresses her concern for the social and emotional development of the 4th graders in her classroom. Many of her students come from troubled homes and violent neighborhoods. Some of the students are pressured to be sexually active, to use drugs and/or to join gangs. She feels that attention to helping disadvantaged children with basic life skills and survival issues (e.g., drugs, gangs, sex ed.) is a neglected area within education restructuring ["We're sent for science training and math training and this training and that training, but you know what? If they're coming to school with this stuff in their heads, how can they concentrate?"]. She feels that at John Wesley, specialized programs dealing with these issues should begin earlier, at the 4th grade level (e.g., the drug program is offered to 5th and 6th graders).

C.C. has initiated informal support groups for the 4th graders in her class. The groups, which are well attended, meet weekly to discuss social and personal issues. C.C. is receiving training in intervention for preteens and adolescents at the local state university extension. She comments that she must sometimes "stop everything" in order to take advantage of the opportunity to teach and discuss "life lessons" with her students. She provides two recent examples. At sharing time, one student described being frightened by gunfire outside his home the night before. This led to a class discussion about what kind of action can and should be taken in situations like this (e.g., calling the police, staying out of danger). Her second example was a situation where a student brought a box of stolen checks to school and was distributing them amongst the class. Once this was discovered, she had a long discussion with the students about the legal and ethical issues involved. She used the classroom telephone to call the woman whose checks had been taken—providing her students with the model of reporting this information and taking appropriate action. She feels that having a telephone in the classroom is crucial to dealing with these kinds of situations as they arise (as well as facilitating communication between classroom and home).

Class Composition C.C.'s classroom is comprised of transitional readers (first year reading in English), Spanish-only readers and a few students who are English readers. She often pairs students, especially in writing, to promote oral and written language development.

Tech in Classroom C.C. has four computers in her classroom (three Macs and an Apple), and comments that "we're constantly on them." She has not made use of the new Mac lab. (Note: she needed to be reminded of what it was and then noted that another teacher had signed up for most of the time). A range of programs are being used by her students. One of the difficulties she has encountered is the unavailability of appropriate software in Spanish. She feels that Spanish materials are often too watered down, noting that the developers do not appear to have the same expectations for the Spanish readers that they do for the English readers. She is frustrated by this discrepancy and strives "to establish more of a balance which reflects equal expectations." Although she laments the lack of Spanish-version software products, she feels that technology supports her goal of establishing equal expectations in a number of ways. When asked to elaborate, the examples she provides are her observations that students are more willing and able to work together at the computer (a context for peer tutoring) and that students are given concrete support for concept development at the computer (through individualized instruction, interactivity, and graphics). She believes that these factors push all students forward in their acquisition of knowledge and skills.

Student Computer Access C.C. estimates individual student computer access to be a minimum of 3 hours per week, and adds that it may be more for some. She encourages students to work in pairs at the computers, which provides each student with greater access. She does not monitor or manage access formally through scheduling. Computer use is often self-selected, although she will sometimes direct a particular group to the computer or will monitor turn taking when the demand is high. "But through most of the day, students are doing a variety of different things, individually and in small groups, and within that context, computers are almost always in use."

3.0 Reform Features [*feature*])

Y	Interdisciplinary
Y	Project-based
Y	Collaborative Learning
N	Mixed Age
Y	Extended Activity
Y	Part of Core Program
Y	Teacher as Coach

The Science Improvement Program curriculum is an interdisciplinary, project-based curriculum that is integrated around science-oriented themes. The current theme in C.C.'s class is whales and marine life. Working in collaborative groups, students select 5 mini-projects or "inquiries" from a list of 20 alternatives provided by the teacher. Many of these activities are open ended and flexible, allowing for independent decision-making on the parts of the students. Students work on their activities over an extended period. The teacher's role as coach is to facilitate collaborative problem solving, to monitor their progress, to offer feedback and guidance, and to orchestrate the use of materials and tools. Most of the projects involve a presentation of a final product to the class (e.g., performing a whale dance, reading a story, singing a song).

Themes are selected through collaborative planning by the John Wesley teachers who are using the Science Improvement Program approach. The teachers meet monthly with a coach (a mentor teacher), who facilitates their discussion and problem solving around the issues involved in developing and implementing this curricular model. Teachers provide one another with a great deal of support during these meetings, offering suggestions, sharing successes, failures and "lessons learned," raising questions and informing one another of newly discovered resources (e.g., materials, training opportunities, field trip sites).

4.0 Description of Activity [*activity*]

C.C. has implemented the Science Improvement Program approach to science-based integrated thematic instruction. The current theme, around which all subject areas are integrated, is whales. Students are given a list of 20 inquiries or projects and are asked to choose 5. She believes that allowing students to self-select from a variety of different types of activities is central to the student-centered and "brain-compatible" approach she is striving to implement. Students may work individually, in pairs, and/or in small groups on their inquiry activities. Collaborative work is encouraged and actively supported, since the teacher feels that students will have more of an opportunity to develop their language and social skills in this context. While students are given flexibility in their activity choices, several of the selected inquiries must involve writing.

Activities within the whale unit include: writing poetry or songs, creating drawings or dances in response to an inquiry; creating maps depicting the migratory patterns of whales; participating in letter writing campaigns (writing letters to the International Whaling Commission, Green Peace, etc.); and writing research reports. The teacher has integrated career studies into the unit through providing materials and presentations on individuals who study marine life (e.g., a female researcher who is working with sharks).

During our classroom observations, students were working in pairs and clusters throughout the classroom on their selected inquiry activities. One group practiced their whale dance, choreographing the slow-motion movements of a whale underwater to the mournful sounds of humpback whales. In another corner, two boys were writing a rap song about "A Whale with a Pail," which they later performed for the entire class. Throughout the morning, pairs of students worked at each of the four classroom computers, writing stories, letters and reports (some in Spanish). One pair of students was logged onto the humpback whale-watching program within Prodigy. During this time the teacher alternated between working at her desk, responding to student requests for assistance, and supporting the various activities through attentive listening, feedback, and encouragement.

5.0 Technologies Involved [*types*]:

Y	Microcomputers
Y	Word processing
N	ILS
N	Spreadsheet
Y	Other LANs
N	Hypermedia
Y	WANs
N	Animation
N	CD-ROM
Y	Simulation
N	Interactive videodisc
N	Videocams and editing equipment
	Other

6.0 Technology Use

- Student Uses [***kiduse***]

Tutorial *[tutor]*

Tutorial software and instructional games are used in many areas of the curriculum. These programs are made available to students during free-choice times, and during individual and group work times. Many of C.C.'s students are working their way through a bilingual reading comprehension program (10 disks) "to help with vocabulary skills." Math software (e.g., Math Blaster) is used to build and practice computation skills. During our classroom observation, pairs of students were exploring a multi-disk tutorial program on gangs. Another program (Poetry Express) tutors students in the different kinds of poetry, providing models and instructional assistance in writing poems.

Exploratory ***[explore]***

Students are using interactive, exploratory software produced by Audubon to study whales and marine life. The software features a variety of activities, which can be flexibly accessed by the students. Students can browse through data cards to gather information about different types of whales. They can go on simulated whale watches, take "pictures" of the whales, listen to whale songs, and track their migratory patterns. They can also create their own data cards to use in research reports. Another exploratory program, available through Prodigy, allows students to track and study the migratory patterns of humpback whales.

Communication ***[commtn]***

Students participate in *National Geographic's* KidsNet for two 6-week periods during the school year. Through KidsNet, the students are linked to classrooms across the country as they engage in group problem solving around a particular science- and geography-based theme (e.g., Solar Energy, Pets). The teacher feels that one of the most valuable benefits provided to her students through their participation is the information they gain regarding how people in other communities live. In addition to KidsNet, students have access throughout the year to the NOVA Kid's Corner network on Prodigy (which the teacher purchased with her own funds for personal use and for use with students). Several of her students have found pen pals whom they communicate with over the NOVA network. Students can also access a range of software, including a series of science quizzes and games and a humpback whale-watching program.

Tool ***[tool]***

The computer is used as a writing tool across the curriculum. Students usually begin by composing with pencil and paper, then enter and edit their text at the computer, although initial composition sometimes occurs at the computer. Most writing at the computer is done collaboratively, in pairs. The teacher provides students with opportunities to engage in a diverse range of writing activities, which she feels are enhanced by the use of the computer. Letter writing is emphasized and encouraged by the teacher as a means for personal empowerment and social activism. Students have written letters to parents (e.g., to thank them for their classroom involvement), school administrators (e.g., to request changes in policy), government officials (e.g., to express their concern about environmental issues) and a variety of organizations (e.g., Greenpeace, the Whaling Commission). In addition to letter writing, students engage in creative writing (stories, poetry, songs), personal narrative and journal writing, and research reports. During our site visit, students were using Children's Publishing Center to design headlines and produce their own newspaper articles about whale sightings.

Students are using Kid Pix as a graphics tool, to engage in freehand and "computer-assisted" design. Students use Kid Pix to create cards and illustrations. Although it is rarely used for writing per se, the program features a Spanish as well as an English alphabet and synthesized speech (naming letters), which students use to explore the letter names in both languages.

- Teacher Uses **[*tchuse*]**

Communication

The teacher mentioned that she had purchased Prodigy for her own use on her home computer (as well as student use in the classroom). She did not elaborate on her use of the network.

Presentation

Not an observed use in this classroom

Instructional Management

The teacher feels that the computer has given her more flexibility as a teacher, allowing for more self-directed activities on the part of her students and freeing her for particular activities.

The teacher comments that she uses the computer as a prescreening tool for "transitioning" students, using instructional software produced by Educational Sources. She is referring to a simplified prereading placement test on comprehension and vocabulary ("It even gives a frustration level!"). She tests all English readers on this at the beginning and end of the year. She notes that this is not a professional test; however, it provides her with useful information regarding individual student levels of understanding and skill. In addition, the printouts depicting the results of each assessment aid the teacher in her communication with parents, providing a concrete and "objective" document that can be referred to during conferences. The teacher comments that she would like to have more of this kind of software, *"where kids can sit down and they think they're having fun, but they're giving you information on their reading levels. I get a printout that I can use for parent conferences—something that says, 'Here,' and if they say, 'Well, I don't think that you're being fair,' I can say, 'Well, this is what the computer came up with.' An unbiased document."*

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration

  Yes. Peer-to-peer collaboration is a central focus within C.C.'s classroom. Most projects and activities are conducted in pairs and in small groups. She feels that this is especially important for children who are transitioning into English reading and writing, because they are provided with many opportunities to develop their oral and written language skills when working together. She also emphasizes the affective and the social aspects of collaborative work, and spends time modeling and coaching students in these areas. She sees the computer as an ideal context for collaboration, based on her observation that children are able to sit at the computer together and engage in a shared activity (writing, reading, and responding to the text in a tutorial, solving math problems), challenging, tutoring, and assisting one another in the process. Because it is her goal to encourage collaboration, the teacher often requires that students work at the computers in pairs, rather than individually.

- Independent exploration

  Yes. The teacher encourages independent exploration throughout the curriculum. She believes that the computer provides an environment in which children are motivated to explore new subject areas and engage in inquiry-based learning activities, often with a partner. She provides interactive, exploratory software, such as the Audubon whale program, in support of this goal.

- Access to outside information resources

  Yes. The teacher purchased Prodigy for her own and for use with her students. She feels that students need to be aware of how to access outside resources through telecommunications. She believes that it is especially important for her students to use this tool as a vehicle for learning about how others live outside of their own community.

- Support for higher-level thinking
  Yes. The teacher believes that technology will support the development of higher-level thinking skills. She feels that the process of learning to master a new technology or a new software program involves important problem-solving skills. She feels that students will be able to engage in more complex tasks with technology (e.g., charting and predicting the migration paths of whales, collaborative writing)—tasks that require advanced skills (e.g., critical thinking and decision-making, scientific inquiry, composition).

- Creativity
  Yes. Through a range of selected software (e.g., *Poetry Express, Kid Pix*), the teacher has made the computer available as a tool for composing songs, writing poetry and creative stories, and drawing.

- Technology skills
  Yes. The teacher feels it is essential for students to learn to master technology, for use within a range of learning activities and particularly as a tool for writing and for telecommunications. She believes that technology use comes naturally to children, especially when they are given opportunities to explore it and to learn from one another.

8.0 Realized Benefits of Technology [*kidout*]

- Motivation ***[motiv]***
  The teacher describes her students as highly motivated to use the computers, for many different types of activities. She estimates that students use the computers a minimum of 3 hours per day. Much of this use is self-selected. She notes that students are willing to engage in activities on the computer that they might otherwise not be interested in (the bilingual reading comprehension program—"they think they're having fun, but they're giving you information...").

The computer appears to be particularly motivating in the area of writing. This is the primary use of the computer in C.C.'s classroom. Students enjoy writing collaboratively, they demonstrate real pride in their products, and they are very interested in producing texts at the computer that can be shared with others. *"The computer is really a natural for them They stay after school to write letters. They ask me, 'Can I stay in from recess to write letters?'"*

- Attendance, time on task, discipline ***[kidbehav]***
  The teacher did not address this issue; however, during our site visitation, students were observed working at the computers for extended periods of time. Two students worked on a tutorial about gangs for over 1 hour. Whether writing, interacting with a tutorial, or logging onto NOVA, most students appeared to be on task at computers for extended periods and stopped working at the computers only when they were asked to by another student who was in need of access, or when instructed to do so by the teacher. While the presence and interest of the researchers may have been a factor, she claimed that this level of interest and activity on the part of her students was typical.

- Amount of collaboration and cooperative learning skills ***[cooplg]***
  While collaboration and cooperation is the norm in the teacher's classroom, these skills appear to be supported by technology in a number of ways. The teacher comments that students often choose (and are explicitly encouraged) to work together at the computer. *"I've also seen kids helping each other a lot at the computer. The ones that pick it up faster, they love teaching it to someone that doesn't know it yet. So it's real good for self-esteem. Plus they like it anyway. So it's not a job teaching it to someone else."* The teacher reports that students who would not speak to her in anything but Spanish will work with an English program and speak English with an English-speaking peer tutor at the computer, in the process developing their English language skills.

- Ability to manage own learning ***[selfreg]***
  The teacher comments that the computer allows students to explore independently and to engage in self-teaching, while at the same time freeing her to do other things. *"The computer is a wonderful self-teacher. They can take their time, so that if a student doesn't like to be rushed, they can just go back over it. And they can*

decide this is what I want to do and they can write it and print it out. And that's kind of how I use high tech."

- Access to outside information resources ***[outinfo]***
  Students in the teacher's classroom are accessing outside resources through their telecommunications activities (KidsNet and Prodigy), and through their use of the computer as a writing tool (writing letters to individuals and organizations). The teacher comments that through KidsNet, students have had an opportunity to learn more about how other people live (this has been more true of some themes than others; not as big a focus within Solar Energy, for example, but an important aspect of Pets). They hear about the types of jobs other students' parents have; for example "this was shocking because our kids have parents that work in the field." In addition, KidsNet has exposed her students to outside experts, such as the college professors who act as mentors within the KidsNet project, analyzing the data results that students have submitted and providing feedback.

- Support for higher-level thinking ***[higher]***
  Two uses of the computer in the teacher's classroom appear to support the development of higher-level thinking skills. When using exploratory software, such as the whale programs (Audubon and on NOVA in Prodigy), students are engaging in a form of scientific inquiry that involves advanced skills such as critical reading and observation, data manipulation, and analysis and prediction.

  The extensive use of the computer as a writing tool within the teacher's classroom has supported students' mastery of the composition process and the written language system. The fact that children are often writing collaboratively (an activity facilitated by the computer) appears to support their development as writers, as they discuss compositional ideas and assist one another with the mechanics of the writing process.

- Complexity of task students can accomplish ***[taskacc]***
  Within the unit on whales, simulation software (the Audubon program and the program available on Prodigy) provides students with opportunities to engage in scientific inquiry within a context that, like the real world, is interactive and dynamic. These programs are flexible and multifaceted—they can be entered into and used at different levels of complexity and in a variety of ways.

Within KidsNet and Prodigy, problem-solving activities are made more challenging and complex as students incorporate new "outside" perspectives and sources of information, while also learning how to communicate their ideas and perspectives to other students in distant locations.

- Learning on specific tasks ***[kidlearn]***
  The teacher feels that collaborative work at the computer supports the development of the oral and written language skills of her students. When writing together, students discuss their compositional ideas and talk explicitly about the mechanics of the written language system (e.g., word choice, spelling, punctuation). They assist one another with various aspects of the writing process. The teacher feels that her transitional students in particular benefit from this mutual assistance.

The teacher has provided a context in which writing is viewed as a meaningful and effective means for self-expression, personal empowerment, and social activism. The professional look and feel of the computer as a writing tool may contribute to the perceived authenticity of the writing task as students write letters and texts to share with others. However, it is the overall social environment that the teacher has established which has provided her students with a sense of the power of written language.

When using tutorials and exploratory software, students read aloud to one another and they discuss the choices and the outcomes they encounter. Often the more advanced English readers will model English reading or will coach their partners in their reading of the texts. The teacher comments, *"They're learning a lot of English by interacting with the peer tutor, and also they're seeing it on the screen, which I can't give them when I'm teaching. I'd have to hold up a bunch of pictures. And they're not as alive as on the computer screen. So it's a natural for language development."*

The teacher's comments were illustrated by the activities of students working together at computers during our classroom observations. For example, two transitional readers (a Latino girl and a Latino boy) were working their way through a tutorial program about gangs, which is written in English. They took turns reading each entry, correcting and assisting one another with the more difficult words. They briefly discussed their responses to the multiple-choice questions that were posed. They stayed with this activity for over an hour and returned to it the next day for another extended period. For these two students, the software appeared to provide a meaningful and motivating context for the practice and development of reading skills.

- Creativity ***[create]***
  Within the whale unit, students are using computer software to engage in creative writing (e.g., writing poems using *Poetry Express*, writing articles and designing headlines using *Children's Publishing Center*) and graphics (e.g., illustrating their whale stories using *Kid Pix* as a freehand drawing tool). In addition to encouraging children's creative expression through these activities, the teacher looks for accuracy in the information being presented (e.g., Does the poem contain interesting facts about whales? Does the drawing of the whale provide an accurate depiction of the whale's anatomy?).

- Greater attention to how a product will be understood by others ***[audience]***
  Collaborative writing activities provide a natural context for the teacher's students to develop audience awareness, as they are reading and responding to one another's writing throughout the composition process. The computer facilitates collaboration and makes it easy for students to share their written products with one another (e.g., readable print, multiple copies).

  Paying attention to how a written product will be understood by the intended reader(s) is an important component of the teacher's approach to writing instruction. For example, letter writing is emphasized and encouraged by the teacher as a means for personal empowerment and social activism. Students have written letters to parents (e.g., to thank them for their classroom involvement), school administrators (e.g., to request changes in policy), government officials (e.g., to express their concern about environmental issues), and a variety of organizations (e.g., Green Peace, the Whaling Commission). The teacher explains, *"I try to teach them that letters have power. One student got a response from the Energy Commission with all kinds of flyers. She didn't know what they said, but she was so proud. And a boy came in this morning with a letter to [the principal] I didn't tell him to write it, but I kept telling them, if you don't like the sound of that bell, then you do something about it, and he wrote a letter.... They get real responses to letters, so* *they like writing them. One of objectives is to teach them how powerful this can be."*

During our site visit, students were using *Children's Publishing Center* to design headlines and to produce their own newspaper articles about whale sightings. The teacher commented that this was a difficult task for her students, given that many of them did not have opportunities to see newspapers in use within their own households. As a beginning activity, she had her students look at a variety of newspapers to examine the way that they were laid out. As with other writing activities within this classroom, careful attention was drawn to creating a product that would be interesting, informative, and in the case of this newspaper, graphically appealing to others.

Within the context of these activities, the computer's use as a writing tool supports attention to audience issues in a number of ways. Its cultural value as a tool within the real world of work, as well as the professional look of the product, may contribute to the sense of empowerment and authenticity that students bring to tasks such as letter-writing campaigns and newspaper production. On a practical level, the computer makes it easier for students to edit and format their texts, and to create multiple copies of their products to share with others.

- Technology skills ***[hackskl]***
  C.C.'s students have learned to use the computer for telecommunications, for writing, and with educational software. C.C. feels that the technical skills involved in using the computer to engage in these activities come naturally to children, especially when learned within the context of meaningful activities. She comments that there are students who know more about particular programs and computer functions than she does, and that students are often able to teach one another how to use the computer more effectively than she can.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: 5th Grade Multicultural Heroes Project

Teacher: C.K.

Site: John Wesley Elementary

1.0 Summary [*sum*]

The multicultural heroes project is a long-term, multidisciplinary, technology-supported project in which 5th grade students are developing and producing a set of materials (videotapes and written texts) focusing on minority leaders—"Multicultural Heroes," both locally and at the state and national level. Working in small collaborative groups and using the interview topics and questions that they developed, students are gathering information about the backgrounds and experiences of minority leaders through videotaped interviews, phone interviews, and written questionnaires. The interviews are being written, edited, and formatted on the computer. Although the class was unable to complete the project by the end of the school year, the plan is for the edited videotapes of the interviews to accompany the written texts. The students hope to find a publisher and plan to market their final product to libraries and other classrooms.

During the 1993-94 school year, the class undertook another interdisciplinary project: the design and implementation of a "Wrap and Rent" mall business. The project is supported by the local mall and is conducted in collaboration with two other classrooms. Students within C.K.'s classroom work in small groups on a range of tasks, some of which are supported by technology (e.g., writing letters to solicit funds, developing jingles for a local radio station, calling local businesses over the telephone to request donations of materials, budgeting expenses).

2.0 Classroom Context [*context*]

C.K. has been teaching for 12 years, the past 9 at John Wesley. He holds a bilingual teaching credential. He first taught in a private high school, then taught at the 1st and 2nd grade level in a small public school in a small town, where he first began using computers instructionally. He taught 1st grade for 4 years at John Wesley, and has taught 5th grade for the past 5 years.

There were 32 5th graders enrolled in C.K.'s 1992-93 class. About 50% of these students were from migrant families, although the majority were not active. There was a lot of influx throughout the year in terms of student enrollment. By the end of the year, C.K. estimated that 40 to 45 students had come through his classroom, with the average enrollment hovering at 30 and a core of 20 to 25 students staying through the duration of the year.

The 1992-93 class consisted of "transitional" readers and English readers. Although it was considered a bilingual class, English was the primary language spoken and all students had transitioned into English reading (some just that year, others 2 years ago, and a few "role models" who had read English all along). Most students were writing in English as well (this due, in part, to the fact that the Spanish version of the word-processing software being used [The Writing Center] was not yet available).

The 1993-94 class is a multi-grade (4th/5th/6th) transitional class with an enrollment of 30 students. For most of the students, this is their first year speaking and writing English in the classroom. A few previous students who were strong in English were kept as models. Altogether, 10 of C.K.'s previous students returned as 6th graders. After 2 years, the composition of the class will be such that there will be a 3-year spread in terms of competence in English (next year, the current 4th and 5th graders will be second-year English readers and the following year, the current 4th graders will be in their third year).

C.K. had some experience using computers in the classroom during his 2 years at the small-town school. When computers became available at John Wesley (the second year of his teaching at the 5th grade level), C.K. was "the first to sign up." He started out with two computers and began "hoarding" them as more became available, since it appeared to him at the time that other teachers were not interested in using them. He was up to six computers in his classroom, until other teachers began requesting them and his number was reduced to four. He currently has two Macs, an Apple GS, and a IIe. He also makes frequent use of the portable Mac lab for writing (eight computers). C.K. estimates that computers are used 3 hours a day (15 hours per week, including 2-hour rotation periods [10:20-12:20 daily] and free-time use).

C.K. describes his previous computer training as minimal, commenting that he has not had any formal training "other than how to turn on the Mac" and a few district-sponsored inservices on the use of *Microsoft Works*. His approach to gaining familiarity and know-how has been to explore each new technology as it becomes available, stepping through manuals and learning through hands-on trial and error alongside his students. He feels that involving the students in this process provides them with important skills, and at the same time, provides him the opportunity to learn from their discoveries. C.K. expresses an interest in more training geared at helping him realize the full potential of what technology has to offer. He adds that the more he learns, the more he dreams of having access to more sophisticated and powerful equipment (*"More training! More power!"*). He is especially interested in expanding current capabilities to provide students with sophisticated ways to integrate sound and video (student produced), laser disc source material and written texts into their products and presentations.

3.0 Reform Features [*feature*]

Y Interdisciplinary
Y Project-based
Y Collaborative Learning
N in 93 Y in 94 Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach

Notes:

The multicultural heroes project brings several areas of the curriculum together: social studies (e.g., researching past and present minority leaders, learning about community resources and cultural organizations, studying the impact of discrimination and learning how individuals dealt with its effects within their own lives), writing (e.g., writing and editing interviews, letters, and narrative texts with a clear sense of purpose and a strong eye towards audience), reading (e.g., critical reading of previous literature on minority leaders, critical reading of their own writing), graphic arts (e.g., designing and creating a mural that will serve as a backdrop during in-classroom interviews, engaging in the graphic design aspects of desktop publishing), oral language skills (e.g., developing phone skills, interview skills, oral persuasion and negotiation skills, drawing from other resources, such as the Oral History Society of the county, to study previous approaches) and math (e.g., budgeting and managing the cost of producing, marketing and distributing the tapes).

C.K. has thought about various ways to incorporate science, which is generally a focus of the multidisciplinary approach to curriculum within the school. C.K. appears uncomfortable with the idea that his project is not incorporating science, since this is such a strong emphasis within other John Wesley classrooms. However, he is having difficulty finding natural ties to the subject area, especially ones that involve the kinds of "hands-on" experiences that are central to the multidisciplinary approach. He is currently considering the possibility of having his students learn more about "how technology works" as a way to bring in science; however, this focus seems forced and is not well integrated into the central themes and issues behind the multicultural heroes project. He notes that students will be learning more about how science fits into the professional careers of medical doctors and leaders within the agricultural community. He would like a more direct and central integration of this subject area. [Note: The project coordinator (J.M.) has commented that John Wesley is shifting from a schoolwide science-based multidisciplinary approach to supporting teachers in building their projects and curricula around various, self-selected subject areas, such as social studies. There was no indication within the school that C.K.'s approach needed to be brought in closer alignment with the multidisciplinary model. However, C.K. may feel that he has less collegial support in that he is not addressing (and therefore is unable to participate in the collaborative problem solving around) the same issues as other teachers who are implementing a science-based curriculum.]

At the beginning of the 1993-94 school year, C.K. made the transition to a multi-grade (4th/5th/6th) class. Altogether, 10 of C.K.'s previous students returned as 6th graders. The mixed age group has expanded opportunities for collaboration; C.K. has the older students act as tutors for the younger and often organizes group activities so that there is a mix of ages and abilities in each group.

The multicultural heroes project involves a great deal of collaborative work on the part of students. Students work in teams and small groups on almost every aspect of the project. Students conduct their interviews in teams of three—with one student serving as the interviewer, another as the camera operator, and a third as a recorder and critical observer. During our classroom observations, small groups of students were constructively engaged in a variety of different activities throughout the room (transcribing interviews, practicing interview skills, scheduling interviews on the phone, researching minority leaders, working on a mural of cultural heroes). C.K. acted as coach, roaming the room and stopping to interact with each group, offering feedback, asking questions, modeling skills. This coaching role is an active and dynamic force in the classroom that appears to strike the balance between allowing students to take the lead and "own" their work, while guiding and challenging their learning and growth and encouraging and maintaining their task-oriented focus. An environment in which peers provide useful feedback and collaborative support is well established. C.K.'s comfort and skill in orchestrating this level of collaborative activity seems to be a key factor in the success of this approach within this context. The formal emphasis on affective growth and social skills (through programs such as TRIBES) within the school also appears to be a contributing factor.

This is a comprehensive extended activity that continued through the end of the school year. Large blocks of time were devoted to the project each day. C.K. decided to teach a 5/6 mixed grade class during the 1993-94 school year to provide the option of extending the project into the next school year with a core group of students.

4.0 Description of Activity [*activity*]

Background. The multicultural heroes project grew out of two needs that were identified by the students and by C.K.. First, in the context of studying the stock market (how money is invested, etc.), students began discussing the shortage of funds within schools and how these shortages had affected their activities and opportunities as John Wesley students. Recent funding cuts had led to the suspension of the 6th graders' participation in a week-long science camp, which previously had been an annual event. The 5th graders in C.K.'s class became interested in finding ways to raise funds to support their participation in the camp the following year.

The second impetus for the project arose out of the need for appropriate curriculum materials featuring Hispanic leaders. The new 5th grade history book was very limited in terms of its minority representation. When students attempted to locate supplementary materials through their school and local libraries, they found that many of the available biographies featured individuals who were either "outdated or not very meaningful" to them (e.g., entertainers who are no longer popular or active, such as Vicki Carr, Trini Lopez, and José Feliciano). Other, more relevant, materials were available but were not written at a 5th grade reading level. The class wanted to create materials on contemporary minority leaders for their own use, and given the general lack of published materials in this area, they wanted to make these materials available to other 5th grade students as well.

Description. Given these motivating factors, the students conceived of the idea of creating a multimedia product (videotape and written texts) on "Multicultural Heroes." The project involves identifying local, as well as several state and national minority leaders (Hispanic, African-American, Native American, Vietnamese) in a variety of fields (including politicians, businessmen, researchers, and educators). Videotaped interviews are conducted with local leaders, in the classroom "studio" (complete with backdrop, camera crew, and audience) and in the community, at their places of work. State and national leaders are interviewed over the phone or are asked to complete questionnaires. The students use a diverse range of resources to help them identify appropriate interview candidates. They have contacted the League of United Latin American Citizens, Mexican-American high school leadership groups, and the NAACP for suggestions. They have used the 1-800 ATT business directory to gather information from national businesses on leadership positions and minority representation. It is C.K.'s hope that some of these contacts will be useful to the students throughout their lives.

The multicultural heroes project is complex and multifaceted, involving students in a range of tasks that require higher-level thinking skills. The first stage of the project was to learn about the interview process. Students conducted a library search and engaged in critical reading of interviews of famous people, analyzing the components of the interviews and noting general areas that they would want to be sure to include in their interviews (e.g., family background, major influences, obstacles faced). They drew upon the Oral History Society of the county as a resource, studying their guidelines and adapting them to suit the needs of the project. They examined the difference between open- versus closed-ended questions and explored methods for getting subjects to provide more detailed information with appropriate follow-up questions. A group of students developed an interview outline, which individual and pairs of students used to generate specific sets of questions. One key aspect of the multicultural heroes project that emerged through this process was a series of questions focusing on the issue of discrimination and how individuals have dealt with this obstacle within their own lives. Once the interview questions were developed, specific techniques for conducting interviews were practiced (e.g., maintaining eye contact, how to hold the mike) in small groups, with students and teacher providing encouragement, feedback, and suggestions. Through this array of interrelated activities, the project has provided a meaningful context for learning complex skills and concepts in a variety of domains (social, affective, cognitive, technical).

Students conduct their interviews in teams of three, with one student serving as interviewer, another as camera operator, and a third as recorder. Each team reviews and critiques their videotaped interview, engaging in discussions about ways to improve their techniques and additional questions that should have been asked. Sitting at the computer together, the team of students transcribes and summarizes their interviews, using both the videotape and the recorder's notes. While entering the text onto the computer for later editing and formatting, the individual students within the team focus on different aspects of the task (e.g., typing, spelling, remembering and repeating what was said on the videotape). Once all of the text is entered and edited, C.K. plans to have students incorporate graphics and pictures using the graphics features within the software (The Writing Center) and a scanner.

At the time of our observation, the class was in the process of soliciting interest in the project on the part of potential financial supporters and publishers. C.K. was coaching his students in the process of making these contacts themselves, through letter writing and phone contacts. As students identified needs within the project, they were encouraged to take responsibility for the follow-up themselves. For example, one student contacted Sears to request the donation of lapel microphones. The student was given a formal request form to complete and return. As the project focus shifts from development and production to publication and marketing, students play active roles in the procurement of funds, the budgeting and management of expenses, the selection of a publisher, and the marketing of their product.

Technology plays a supportive role within the multicultural heroes project. Telephones, computers, video equipment, scanners, and laser disc players are used as tools to accomplish a range of specific tasks within the context of the broader project. While the technology is not a central focus in and of itself, many aspects of this project would not have been possible without its use (e.g., conducting telephone interviews, videotape production, creating written products of professional quality).

1994 Update. C.K. was interviewed again in April 1994 and concerning his prior year's class. Students had called community leaders and gone out in teams and interviewed individuals such as the city manager and a local anchorman. Their trip to the local television station was especially interesting because the students were able to see how the computer is used in the media (e.g., weather display). Some interviews were conducted in the classroom as planned, with the mural that students had created in the background. Interviews were partially transcribed on the computer, and this proved to be a time-consuming process. Students ran out of time and were unable complete the project. They were unable to edit the videotapes due to lack of time and equipment. A group of students wrote follow-up letters over the summer requesting new interviews with additional community leaders.

C.K. would like to return to the project at a later point; he states that it is on temporary hold. Tapes and texts will be edited later in the school year. A future goal is to conduct interviews with individuals representing more diverse ethnic groups (Chicano and African-American communities are represented; C.K. would like to represent Filipino and Japanese communities). At the end of the school year, C.K. decided to team teach a 4/5/6 class with another teacher (Mr. E.) for 1994-95. He hopes to pick up and extend the multicultural heroes project with his new teaching partner, who "also wants to work on empowerment."

The Mall Project. C.K. introduced a new multidisciplinary project in 1993-94, absorbing the time that was devoted to the heroes project in the prior year. The students worked collaboratively on the design and implementation of a Wrap and Rent Center at the local mall. The project was sponsored by the mall management, with major financial and training assistance provided by two mall businesses, one a large department store and the other a small shop. Like the heroes project, the mall project was intended as a fund-raiser (with proceeds benefiting participating schools).

The original idea for the mall business came from a migrant coordinator who was working with migrant students in a modeling program at the mall. A mall manager approached the migrant coordinator and suggested the idea of a kids' retail academy. She had seen a similar program in Chicago; however, at that site the store was set up by the adults and run by the students. The idea behind this project was to teach students business skills through the experience of building a mall business from the ground up. The migrant coordinator sent a flyer to teachers in the county school district and three responded (two at John Wesley, including C.K.).

The project is for 6th graders only. Since C.K. has a mixed-grade class, he has found ways to involve all students through integrating the mall project into the overall curriculum. The 6th graders attend training on location at the mall on Wednesdays, returning to the class on Thursdays to teach the rest of their class what they have learned. On the evening of our interview, the students were to attend a gift-wrapping training session conducted by the department store. Later in the month, representatives came to C.K.'s class (by invitation of the students) to demonstrate their products.

Initial meetings sponsored by the mall with the students focused on the selection of the type of business to be operated. Students conducted a market survey, polling their parents and mall patrons regarding the mall services that they would like to see provided. A list was generated, which included: baseball cards, comic books, strollers, and a gift-wrapping service. The group determined that in a kiosk situation, a gift-wrapping service would probably be the best place to start (comic books need to be displayed and require security to prevent theft). Students did follow-up surveys with focus groups. They researched the cost of supplies and solicited donations, both over the telephone and through the mail. They drafted a letter to the mall sponsors to request funds. The sponsoring businesses agreed to put up a total of $4K to cover start-up costs; however, the students first had to provide a detailed cost analysis.

The project was integrated into the school day, with students working in small mixed-age groups on different tasks. During the daily rotation period, students went from station to station: the mall project was one of the stations. The day of my observation, a group of students were calling local businesses to request donations of strollers and wheelchairs; while another group designed bag stuffers on *Kid Pix* and wrote letters using *The Writing Center* at the computers. Like the heroes project, this project involves all aspects of the curriculum. Students can develop oral and written language skills as they gather information over the phone, write letters to solicit donations, and develop jingles for advertising over the local radio station. Math was brought in through cost comparisons and budgeting. Cooperative skills came into play as students divided responsibilities and collaborated on tasks. Developing specific skills and concepts in business operations was a key component of the project.

Technology was integrated as a tool to support project activities, primarily as a word processor and for graphics design. C.K. did not use a spreadsheet for budgeting, but may do so in the future.

In July 1994, C.K. reported that the students finished their kiosk, but a change in mall management precluded them from actually implementing their business. He felt that the students had nevertheless learned a great deal from their planning and implementation activities.

The transition to a mixed class has led C.K. to rethink his curriculum. The social studies and history framework at John Wesley is that the 4th grade studies state history, the 5th grade studies the United States, and the 6th grade studies the world. Rather than choosing one area of study and alternating each year, C.K. is trying to relate three different subjects. For example, the students began studying the western states, which were related to Central and South America. They then moved on to the southern states and studied Africa in relation to slavery. They are currently studying northeastern states and studying the European countries where many of the first settlers came from. They will then return to the western states, tying in Asia. C.K. has adopted a curriculum in which students study cultural universals (e.g., clothing, shelter, transportation, religion, recreation) and then create a culture of their own. They will create and bury artifacts, which another classroom team will dig up and attempt to piece together (as clues to an unknown culture).

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y Microcomputers
Y Word processing
N ILS
N Spreadsheet
Y Other LANs
N Hypermedia
Y WANs
N Animation
Y CD-ROM
N Simulation
Y Interactive videodisc
Y Videocams and editing equipment
Other

Note: Although they are not used within the multicultural heroes project, CD-ROM and WAN are used within other areas of the curriculum (e.g., books on CD-ROM for reading, KidsNet for science).

During the 1992-93 school year, there were four permanent computers in C.K.'s classroom: a IIe, a IIgs, and two Macs. A duo dock powerbook was added in 1993-94. C.K. makes frequent use of the portable Mac lab (six additional LCs).

In April 1994, the classroom was linked to a school network with a central file server linked to the Internet. C.K. used the network to download software and to access information sources, such as *Grolier's Encyclopedia*. A school e-mail system became operational in the summer of 1994. Plans to link with other classrooms and outside information resources are being developed and will probably be acted upon next year.

6.0 Technology Use

- Student Uses [***kiduse***]

Tutorial ***[tutor]***

Tutorial software is used in the classroom within several areas of the curriculum, but does not have a role in the multicultural heroes project. Instructional games, such as Math Blaster and Number Maze, are used to "boost" math skills. C.K. prefers to provide math software that can be adjusted to match the students' levels of skill and understanding. Math software is regularly made available at rotation time and during free-choice times (before school, recess, lunch). Although his recent focus has been on computer-supported writing activities, in the past C.K. has structured the computer component of rotation times around particular subject areas, such as math and science, offering a range of programs for students to choose from.

C.K.'s students are learning and practicing keyboarding skills several times a week, using tutorial software designed for this purpose. C.K. feels that ease of typing is essential to the flow of generating ideas during writing. He sees this as a critical skill for future success in school and work. John Wesley has recently developed a computer literacy continuum that places the development of keyboarding skills in the early grades, *"so that by the time they get to 5th grade, it's not all hunt and peck."* However, C.K.'s students have not had the benefit of this prior training, so this has become an important emphasis within his classroom.

Exploratory ***[explore]***

Simulation software, such as SimAnt, has been offered to students during rotation and free-choice times. Other exploratory programs include math/science software, such as a program in which students manipulate and predict the speed of airplanes and cars (exploring factors such as slope of ramp, weight of car, etc.). As with the tutorial software, these programs have supplemented the curriculum, but they are not integrated with or central to the core project.

Communication ***[commtn]***

Twice each school year, students in C.K.'s classroom participate in *National Geographic's* KidsNet, a network-supported 6 week science-oriented research project focusing on a particular issue or theme (e.g., solar energy, pets, water and pollution). The students collect their own data locally and share their observations and emerging theories with other students throughout the state and in other countries. Many students have developed pen-pal relationships with students in other communities over KidsNet, which they have continued even after the 6-week session ends.

In April 1994, the classroom was linked to a school network with a central file server linked to the Internet. C.K. used the network to download software and to access information sources, such as *Grolier's Encyclopedia*. A school E-mail system became operational in the summer of 1994. Plans to link with other classrooms and outside information resources are being developed and will probably be acted upon next year.

Tool ***[tool]***

The primary use of computers within the multicultural heroes project, and within C.K.'s classroom in general, is as a writing tool. Within the project, students transcribe and summarize interviews, which they then edit and format in preparation for publication. Students also prepare a written questionnaire (to be sent out to nonlocal minority leaders) and write letters to local businesses and organizations to solicit financial support, donated materials, and interest in their product. C.K. feels that it is important for students to engage in a range of different types of writing. Other computer-supported writing activities include creative story writing, research reports, and a class recipe book. The class is currently considering the production of a school newsletter (another potential fund raiser).

Most writing at the computer is done collaboratively, with students writing in small groups or pairs. Until recently, students usually wrote their first drafts with pencil and paper, and then entered their text at the computer for final editing. Lack of keyboarding skills and the fact that there were only four computers in a classroom of 32 students made initial composition at the computer difficult. Now that the students are acquiring keyboarding skills and the Mac lab is available, C.K. encourages students to write their first drafts at the computer.

John Wesley recently acquired a multimedia station that is just beginning to be used by the students in C.K.'s classroom. At the time of our observation, groups of students were learning to operate the laser disc player, exploring images, sounds, and video clips on the *Visual Almanac*. C.K.'s goal is to get students to the point where they will be able to use this technology as a tool to develop their research reports and presentations (incorporating graphics, video, sound, and text).

- Teacher Uses **[*tchuse*]**
  C.K. did not discuss uses of technology for instructional management, presentations, or communication.

- Communication
  C.K.'s class is equipped with a telephone, which is used for communication with parents and other teachers. To date, computers have not been used by C.K. for communication purposes. During the 1993-94 school year, a LAN was installed that will be used beginning in 1994-95 for communication between faculty and staff members at the school. The school e-mail system became operational in the summer of 1994. Plans to link with other classrooms and outside information resources are being developed and will probably be acted upon next year.

- Presentation
  The laser disc player is used for classroom presentations

- Instructional Management
  C.K. reports that he does not use the computer for instructional management. His primary professional use is for writing.

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration
  Yes. Collaborative learning is an overall goal and approach within C.K.'s classroom. Technology is viewed as providing a supportive context for collaborative activities.

- Independent exploration

  Yes. C.K. encourages independent exploration in his classroom generally, allowing students to take the lead in project-based activities. It is his goal to provide further opportunities for motivated and constructive independent exploration through technology use. For example, rather than following teacher-directed instructions, students are allowed and encouraged to explore new technologies (e.g., the multimedia system) as they become available.

- Access to outside information resources

  Yes. It is C.K.'s goal that participation in KidsNet and other similar activities will help students understand the importance of *"the concept that they can communicate with others over the computer."* Because he views this as a primary means for accessing information and resources in the future, he feels that experience in this area is critical to his students' preparation for later schooling and work.

- Support for higher-level thinking

  Yes. It is C.K.'s goal to support higher-level thinking through providing his students with opportunities to engage in complex tasks that are facilitated by technology.

- Creativity

  Yes. C.K. feels that the computer provides another tool for students to engage in creative self-expression.

- Technology skills

  Yes. C.K. feels strongly about the importance of providing his students with the opportunities to explore and to learn to use technology. It is his stated goal to help students *"learn to use the computer to its fullest extent."* He believes that having these skills will give his students "the advantage" when they have greater access to technology, in high school and in the workplace *("the idea that they have the skill and they're comfortable with it.... They'll be more prepared in school and when they get out into the job force.")*. He wants to relay to his students the potential of technology so that they can understand and incorporate its uses in ways that help them get ahead in the world. C.K. sees specific technology-related skills, such as keyboarding, as critical to the workplace. He wants his students to feel confident in their own abilities to explore and eventually master new technologies, and provides them with many opportunities to experience this process firsthand.

8.0 Realized Benefits of Technology [*kidout*]

- Motivation ***[motiv]***
  When asked about the impact of technology on student motivation, C.K. comments that, *"they all want to get on the computer."* He sees motivational benefits within specific subject areas. C.K. believes that having the computer available as a writing tool has increased his students' motivation to write. Some students who were previously reluctant to write with a pencil are now motivated to write at the computer. Last year, almost all of his students created books for the annual Book Fair; C.K. attributes this unusually high level of participation to the computer. He feels that the professional-looking quality of the materials they are able to produce at the computer and the ease of collaboration supported by this writing environment play important roles in his students' increased motivation.

  Students enjoy using the instructional games and simulation software in math and science. C.K. observes that, with the computer, *"they may be doing things where they would not have had an interest in it before, trying new things out, working on math skills,"* for example. Students will often stay in from recess or come into school early in order to "play" at the computer. He jokingly comments that when students come in at 8 a.m. to use the computers, *"I've structured in manners so that they have to say, 'Hello, C.K.! How are you doing?' before they can say, 'Can I use the computers?'"* He notes that a lot of students now want computers in their home and are interested in learning about what kinds of programs are available for home use.

  Although students continue to enjoy the game-like activities they are able to engage in at the computer, C.K. believes that students have shifted in their perception of technology, from viewing it as a form of recreation to viewing it as a useful (and fun) tool: *"Before computers were like, 'Okay, we can play now!' Now it's the idea that we can use the computer to do a lot of things. It's more than just a game."*

- Attendance, time on task, discipline ***[kidbehav]***
  Prior to using computers in his classroom, C.K. structured his rotation period around 20-minute activity blocks. Once computers were introduced, C.K. found that students needed longer blocks of time to engage in their computer-supported activities (writing, instructional and exploratory software). He restructured his rotation time around 40-minute blocks, providing the students with more needed time on task.

  C.K. observes that students are willing to spend a great deal of time on task when they are exploring a new technology. During our classroom observation, a small group of students gave an hour-long demonstration to the rest of the class on how to use the laser disc. The students, for the most part, remained interested and attentive throughout. C.K. commented that this level of interest is unusual in general, but is typical of how students respond to technology. He recently explored CD-ROM for the first time with a small group of students. The session lasted 2 hours. While these examples do not address the impact on time on task once the novelty factor is no longer in play, they indicate the potential technology holds for stimulating student interest and holding their attention. Our further observations appear to support the idea that the use of technology coupled with the engagement in tasks that are personally meaningful to students is a powerful combination in terms of motivation and time on task.

- Amount of collaboration and cooperative learning skills ***[cooplg]***
  Students are often paired at the computers during rotation and writing times. Most of their writing at computers is done collaboratively, with students scaffolding the writing task for one another, each focusing on different aspects of the writing process (e.g., one generates story ideas and the other focuses on spelling and text entry). C.K. comments that his students rarely collaborate when writing with the pencil. In addition to the fact that computers are often shared because of limited access, there are characteristics associated with the

computer that may be particularly conducive to collaboration, such as the public display of uniform text on screen, the use of the keyboard as an input device (a shared referent that makes a number of writing choices explicit), and the ability to print out multiple copies.

Many of the activities within C.K.'s classroom are conducted in small cooperative learning groups. Within the multicultural heroes project, technology-supported tasks (e.g., conducting and videotaping interviews, transcribing the videotaped interviews, editing and publishing texts and videos) provide a rich context for collaborative work.

- Ability to manage own learning ***[selfreg]***
  Students in C.K.'s classroom are encouraged to take responsibility for many of their learning activities, usually within the context of a supportive peer group. Technology appears to play an indirect role in facilitating self-regulation at several levels. It provides students with a tool to assist them in monitoring their progress and growth (e.g., through feedback presented in instructional software) and with a means for evaluating their work (e.g., through critical viewing of videotapes, opportunities to share and critique one another's texts).

- Access to outside information resources ***[outinfo]***
  The telephones within C.K.'s classroom are used extensively within the multicultural heroes project—to contact interview candidates, to schedule and conduct interviews, and to solicit donated materials and funds. Students have contacted a number of agencies and organizations as potential resources (e.g., NAACP), via telephones and letter writing. In another area of the curriculum, KidsNet has provided students with the opportunity to learn about and from students in distant communities.

  In April 1994, the classroom was linked to a school network with a central file server linked to the Internet. C.K. used the network to download software and to access information sources, such as *Grolier's Encyclopedia*. A school e-mail system became operational in the summer of 1994. Plans to link with other classrooms and outside information resources are being developed and will probably be acted upon next year.

- Support for higher-level thinking ***[higher]***

  Within the multicultural heroes project, students are engaging in a range of tasks that require higher-level thinking skills. Technology plays an integral role as a tool that supports their information gathering, critical reading, writing, and editing of text and video.

  C.K.'s approach to involving students in the process of exploring and identifying relevant uses of new technologies is a good example of how technology supports higher-level thinking and problem solving in this classroom. Rather than providing students with a teacher-led demonstration on the uses of technology, C.K. allows his students to take lead roles in figuring out how to make the technology work and, more importantly, in determining how to tie its uses into their current individual and group interests and activities.

- Complexity of task students can accomplish ***[taskacc]***

  Technology has provided C.K.'s students with the tools needed to reach their goal of developing and producing "professional-quality" written and video products that others may find useful and worthwhile.. The project involves the orchestration of a range of complex tasks (e.g., developing interview protocols and questionnaires, conducting interviews, summarizing key points from the videotaped interviews, writing and editing biographical profiles, marketing the product). Many of these individual tasks would not be possible without the use of technology.

  Within the area of writing generally, C.K. comments that students are more likely and able to edit their texts given the support of a word processor. The fact that students are writing collaboratively at the computer, scaffolding various aspects of the task for one another and providing critical feedback, appears to support a higher level of writing than would be achieved individually.

  Within KidsNet, students are provided with information and perspectives that add to the complexity of the "problem space" as it is defined by the issues at hand. As in the heroes project, they must find ways to effectively communicate their own information and perspectives to a nonpresent audience.

- Learning on specific tasks ***[kidlearn]***

  Tutorial software is used within C.K.'s classroom to promote math skills and to teach keyboarding. C.K. feels that the software used provides a context in which students are motivated to practice, which advances their mastery of specific skills within these areas (e.g., computational skills, touch typing skills).

  C.K. believes that the use of the computer as a writing tool has altered his students' perceptions of and approaches to writing. He feels that students are more willing to write and are more likely and able to edit their texts at the computer. He also observes that collaborative writing, which is facilitated by the computer, provides a context in which students learn about different aspects of the writing process from one another. The ability to publicly display and/or print out text that has a professional appearance has resulted in an increase in students' sharing and giving/receiving feedback regarding their written products. Each of these factors has contributed to C.K.'s perception that the use of the computer as a writing tool has increased both the competence and the confidence levels of his students as writers.

- Creativity ***[create]***

  C.K. believes that the computer offers his students another modality and means for creative self-expression. The students design their own graphics and engage in creative writing at the computer.

- Greater attention to how a product will be understood by others ***[audience]***

  C.K. states that the computer has altered his students' approaches to writing, in particular allowing them to create professional-looking products that others will want to read. For some students, difficulty with manual transcription can prevent them from sharing their writing with others. C.K. comments that for these students in particular, the computer *"is especially nice...because people are actually able to read what you have written."*

  The fact that students are creating written and video products in collaboration with one another, rather than in isolation, provides them with immediate and ongoing feedback and a concrete sense of audience. C.K.'s role is central here, as he models and supports the process of providing constructive feedback, and calls attention to audience issues. The technology seems to provide a framework that is conducive to students viewing their work as products to be shared with others. Within the multicultural heroes project, the goal to create something that others will actually want to purchase and use adds another dimension to the concern for audience.

- Technology skills ***[hackskl]***

  The acquisition of technology skills and concepts within the context of meaningful tasks is a key focus within C.K.'s classroom. With each new technology that has been introduced, C.K. has involved students in the process of exploration and discovery—working together in small groups, they walk their way through the manuals, learn by trial and error, and identify links to both individual and group interests. Students are given the responsibility of teaching other students in the use of technology, in the process building on their own knowledge and skills. Students are encouraged to come up with their own approaches to incorporating new technologies into their work, both independently and within their groups. For example, within the heroes project, one student chose to do an independent study and report on minority leaders of the past. She plans to use the laser disc to incorporate images of Native American leaders as part of her final product and presentation. Specific technology oriented concepts (e.g., the notion that computers provide access to outside resources) and skills (e.g., keyboarding) are stressed, but always in relation to an authentic task or purpose.

Recommendations

In reflecting on his recommendations to others, C.K. encourages teachers to set aside their fears about technology and to allow students to take an active role in their learning process. *"The biggest thing I'd have to say about somebody just starting out is not to be afraid of it. I've seen so many teachers that don't utilize computers because for 2 or 3 years it's, 'How do you plug this in?' Well, the cord goes here! You can't really hurt them that much...if you have your disks, you just reload it. So explore. Have fun with it. It shouldn't be something to be afraid of. It should be, 'Wow! What will happen if I do this? Oh, okay! Well, what if I try this out?' And kids are great at that, so use the kids to help you out. If I get stuck, one* *will say, 'Hey, look at this [C.K.]!' From my perspective, a lot of times they can figure things out. They've got more flexible minds, or the more minds the merrier for figuring something out [and asking] 'How is this going to do that?' ...I think that's the biggest obstacle. So don't be afraid."*

MAYNARD SCHOOL DEBRIEFING

Site: Maynard School

Contact: P.Q.
Computer Coordinator

1.0 Summary [*sum*]

This school-within-a-school encompasses eight classes spanning grades 4-6. The most striking features of the program are: smaller, more coherent classes, most of which are co-located on a single floor and extensive access to network and tool technology to support communication and research. The program also seeks to organize activities around collaborative projects and investigations and to offer teachers a greater chance to collaborate and to participate in decision-making (School Self Reports, 1991-92).

2.0 Context and Reform Overview

2.1 Educational Context. [*context*]

Setting (e.g., urban, rural, suburban). The Computer Mini-School occupies the fourth floor of a grade 3-6 elementary school located in a northeastern city, not far from a university. Most of the students come from a neighboring public housing project. The school building, constructed in 1925, shows many signs of age and decay on the outside and in the corridors, but the classrooms themselves are cheerful, with high ceilings, and large windows. Hallways are lined with colorful displays of children's artwork and writing.

Grade levels.
The Computer Mini-School consists of 8 classrooms spanning grades 4-6; the school as a whole includes grade 3 as well.

2.2 Demographic Information [*demo*]

Applicable unit: [✓ School] Class [✓ Project] District Other

Number of certified teachers (FTE): 8 in Mini-School plus Technology Coordinator (P.Q.); 37 in whole school

Enrollment as of 9/93: 171 in Mini-School; 713 whole school

Number or percent free or reduced lunch: 77% (of whole school)

Number or percent LEP or NEP: 45 LEP students in school; mostly Spanish or Haitian Creole speaking; few LEP in Mini-School

Number or percent special education: Unknown number with learning disabilities in Mini-School; school has a separate special education class; 63 students (8%) were classified as special education in 1992-93.

Ethnic Composition *(Number or percent in each category)*

71%	27%	<1%
African American	Hispanic	Caucasian, Non-Hispanic
<1%	1%	
Native American	Asian/Pacific Islander	Other

Estimated percent students w/computers in home: 5-10%

2.3 Education Indicators *[stats]*

Since its first year of operation, the Mini-School has performed well in terms of available indicators. Student performance on the district and state standardized tests is better than that of other Maynard students, particularly in math. There are more applications for places in the school than places available; last year they had two applications for every fourth-grade slot. Although data are not maintained for the Mini-School which is not an "official" organizational unit, all anecdotal reports are that there are fewer disciplinary incidents within the Mini-School than in the rest of the school. Several students from the Mini-School have been admitted into selective public or private school programs after leaving Maynard.

2.4 Reform History *[reform]*.

- Nature and when started *[history]*
  In 1987, P.Q., the computer teacher at Maynard, and several other teachers began working with N.N., then at a local college of education, on the Earth Lab project. Earth Lab, funded initially by the NSF and subsequently with support from the Apple Computer Corporation, involved the development of a Corvus network that would support elementary and middle school students as they worked on collaborative science projects.

Subsequently, the school got a grant from Corvus and Apple Computer to upgrade the lab.

The Earth Lab project enabled the school to obtain additional computers and set up a local area network with a file server so that students could maintain their project work in special folders or "workspaces" set up for project collaborative activities. With this infrastructure in place, the students and teachers began setting up folders for other school activities, such as the student newspaper. The kind of collaborative activity and project-based work supported by Earth Lab started spreading to other school activities, and the boundaries between different subject areas, class periods, and even school years became less rigid.

In 1990 P.Q. and six classroom teachers asked the administration for permission to set up a mini-school. A large part of the incentive for this proposal was the teachers' concern that much of the pull-out and specialized programs their students were getting as part of Chapter 1, departmentalization, and coverage for the teachers' "prep" periods was ineffective. They sought a way to give students a more coherent program, to reduce class size, and to insulate students from ineffective teachers and aides. The teachers agreed to give up the prep period that was in their contract in return for increased authority in designing their instructional program and smaller class size (an average of 20 students versus the 32 in regular classes). In the fall of 1990 the Computer Mini-School opened. In 1992-93 two more classes were added to the Mini-School.

The Mini-School classes are scheduled into the Computer Lab for two periods each week. In addition, students and teachers can come into the main lab or the adjacent ILS lab (which is also on the same network) anytime there are available computers and before school, during lunch, and after school. Each student in the Mini-School has an electronic mail account. Most other Maynard students do not have these accounts, however, they are provided to any student who requests one. All Maynard students can come to the Computer Room and use software resources before or after school or at lunch.

In the fall of 1993 construction related to asbestos problems meant that a number of classrooms were not available for several months. Several Mini-School teachers had to share classrooms. Two of the teachers found that they enjoyed the team teaching so much that they have continued the arrangement and expect to add a third teacher to their team next year. These teachers are also very involved with a reading and writing process project out of a nearby university.

- Reform Features **[*feature*]** (check all that apply)

  Nongraded groupings
  X Extended periods
  X Schoolwide themes
  Teacher professionalization
  Authentic assessment
  X Use of outside resources.

- Key Individuals **[*key*]**

  P.Q. is the Mini-School Computer Coordinator. A self-taught computer and networking expert, P.Q. led the effort to create the Computer-Mini School. He manages the computer lab and is responsible for the technology component of the program. In collaboration with N.N. (initially at a nearby college of education), P.Q. developed and implemented the Earth Lab project at Maynard. The success and notoriety of this project has provided P.Q. with leverage for securing additional funds and equipment through his grant-writing efforts. In addition to his role at Maynard, P.Q. took on the role of district technology coordinator in 1992.

  M.M. is a sixth-grade teacher within the Computer Mini-School. She was instrumental in the establishment of the Mini-School and is one of the most active teachers with respect to technology use. M.M. spends many after-school sessions in the computer lab, working with students and developing her own technology skills. She works collaboratively with P.Q. on projects that integrate technology with the curriculum. Before the Mini-School began, M.M.'s class served as a testbed for the *Earth Lab* and *Second Voyage of the Mimi.*

K.T. is a sixth-grade teacher within the Computer Mini-School. She was one of six teachers to set up the Mini-School in 1990. **A.P.** began teaching at Maynard as a computer writing teacher in the regular school. She joined the Mini-School as a fifth-grade teacher in 1992. K.T. and A.P. began team teaching in the Fall of 1993, initially due to a classroom shortage caused by an asbestos crisis. The arrangement worked out so well that they continued their combined class even after another classroom became available. The two teachers have developed a strong reading and writing process program, based on their ongoing work with the nearby teacher's college. The program has brought them recognition within the school as well as the wider educational community. They are currently involved in a research project with a university researcher focusing on an instructional approach in which students develop critical reading and comprehension skills through participation in collaborative small group "Book Clubs." K.T. and A.P.'s curriculum is organized around collaborative project-based activities. Students use the computer lab as an extension of the classroom, for research, word processing, desktop publishing, and math related activities.

- Funding sources for reform **[*funds*]**

  For the most part, the restructuring aspects of the Mini-School have been funded through the school's regular allocation, with funds redistributed in a way that permits smaller class size. Part of this resulted from the Mini-School teachers' willingness to give up their prep periods and part from the use of the Mini-School teachers' "share" of Chapter 1 funds to support an additional position.

- District involvement/support **[*localref*]**

  The reform started at the grass roots (teacher) level. During the first year, the district got nervous about the way Chapter 1 funds were being used to partially support the Mini-School and in midyear it asked the school to go back to Chapter 1 pull-out programs in anticipation of an upcoming federal audit. The federal auditors themselves, however, were supportive of the Mini-School arrangement, and the district has come to see the program as a model innovation.

The district superintendent makes himself available to the project director to help unravel the bureaucratic red tape that often stymies activities such as equipment or software purchases. Early on, he used his contacts with the union hierarchy to prevent the union local from suing to block the Mini-School teachers from giving up their prep periods. Currently, the project director (P.Q.) is supported through a district line and is responsible for supporting technology use throughout the district although most of his time is still spent at Maynard.

The district administrators appear supportive of the Computer Mini-School and in general are trying to support a number of special projects within the district (other examples include the school that has taken on development of an inner-city park, a Teacher Enhancement grant proposal to NSF, Don Nix's multimedia development of civil rights curriculum units at another elementary school, and a highly selective secondary-level academy). The district superintendent said that he is trying to promote portfolio and alternative assessment, more interactive teaching, and an emphasis on higher-order thinking skills rather than teaching to the test.

Above the district level, authority resides in the City School Board. The Chancellor is trying to implement some reforms citywide—notably site-based management and portfolio assessment. From discussions with people at the school level, however, we got the impression that the citywide reforms thus far were mostly on paper. The school does not have an active site-based management council and does not expect the city initiative to have any real effect. Similarly, although some of the teachers keep portfolios of student work, this is not done in any systematic way as part of an assessment project and there are no plans for making this happen.

- State/federal involvement/support **[*stateref*]**
  Chapter 1 funds have been used to fund a position that helped cut class size for Mini-School students. In addition, federally funded research grants were pivotal in getting the technology innovation off the ground (through the Earth Lab and National Testbed projects).

- Role of tech in reform efforts **[*techref*]**
  X Part of initial reform concept
  Emerging part of reform efforts
  Parallel effort

3.0 History of Tech Applications

3.1 Incentive for Technology Use *[why]*

A large part of the incentive for this technology innovation was organizational. Teachers felt that much of the pull-out and specialized programs their students were getting as part of Chapter 1, departmentalization, and coverage for the teachers' "prep" periods was ineffective. They sought a way to give students a more coherent program, to reduce class size, and to insulate students from ineffective teachers and aides. For many of the teachers joining the Mini-School, the technology was almost incidental. P.Q., however, building on his involvement in Earth Lab, saw the technology as a support for collaborative projects and a more "seamless" program of instruction, allowing students to continue working on their projects at different times of day and from different locations.

3.2 When & How Application Started *[how]*

In 1987 P.Q., the computer teacher at Maynard, and several other teachers began working with N.N., then at a local college of education, on the Earth Lab project (funded by the National Science Foundation). Earth Lab involved the development of a Corvus network that would support elementary and middle school students as they worked on collaborative science projects. Subsequently, the school got a grant from Corvus to upgrade the lab.

The Earth Lab project enabled the school to obtain additional computers and set up a local area network with a file server so that students could maintain their project work in special folders or "workspaces" set up for project collaborative activities. With this infrastructure in place, the students and teachers began setting up folders for other school activities such as the student newspaper, and students acquired facility with computer tools such as word processing, spreadsheet, and graphics software.

Around 1989, the program received a grant from Apple to convert the lab to an Apple system (using Apple IIes) and an AppleShare version of Earth Lab. At about the same time, P.Q. and six classroom teachers asked the administration for permission to set up a mini-school. The teachers agreed to give up the prep period that was in their contract in return for increased authority in designing their instructional program and smaller class size (an average of 20 students versus the 30-35 in regular classes). In the fall of 1990 the Computer Mini-School opened.

The Mini-School classes are scheduled into the Computer Lab for two periods each week. In addition, students and teachers can come into the main lab or the adjacent ILS lab (which is also on the same network) any time there are available computers and before school, during lunch, and after school. Each student in the Mini-School has an electronic mail account. Other Maynard students do not have these accounts but they can come to the Computer Room before or after school or at lunch.

In addition to the original Computer Room, an adjacent ILS lab was added in 1993. The ILS lab is used for non-Mini-School classes, including several special education classes. Both Mini-School and other Maynard students use this lab before and after school and during lunch.

In 1993 the school got a larger grant ($100,000) from Apple which allowed them to purchase Macintosh computers and move to a MacFinder network that included many of the features they had programmed for Earth Lab as standard features. This was a leadership grant that enabled the network to be extended to a neighboring school. Of the $100,000, $80,000 went towards the purchase of equipment, $10,000 to software, and $10,000 to support the connection into the other schools (two thirds of each amount went to the neighboring school). Through an NSF grant to N.N. (now at a research firm) for the development of a national education networking testbed, the Mini-School got a high-speed data line and an Internet server. Rather than having to log onto a server somewhere else where they would have to cope with the hard-to-use UNIX environment, students in the Mini-School can use the same network interface they use on their local network and up to 80 students can use the Internet at once because of this client server model of Internet access. N.N.'s grant has supported Maynard's Internet connection (at a cost of $15,000 a year) and will continue to do so through November 1994.

3.3 Technologies Used *[types]*

- X Microcomputers (over 50 Macs, Gateway 2000 file server, 32 Apple IIe)
- X ILS (21 Macs in CNS ILS lab, 32 IIes in another)
- X Other LANs (school network connected to CNS ILS & administrative network)
- X Interactive videodisc - Yes
- X WANs - Internet connection, Gopher Server, World Wide Web Sever
- X CD-ROM - Yes
- X Videocams and editing equipment - Yes, had a video club
- X Word processing (Claris Works)
- X Spreadsheet
- X Hypermedia
- X Simulation - Not much
- X Animation - No specialized software
- X Other - Router and high-speed data lease line; real-time video conferencing through "C U See Me" software; Gopher, Mosaic

3.4 Target Grades & Curricula *[levels, curric]*

Grades 4-6, all content areas

3.5 Key School Players *[infield]*

P.Q. handles the computer room and was the linchpin in organizing the Mini-School. He is careful to say that he is not the "head" of the school, however. While there appears to have been some confusion around roles, P.Q. seeks to make decisions about the offerings and structure of the computer lab and to have the teachers as a group make instructional decisions (e.g., recently, how to handle a particularly difficult emotionally disturbed student). P.Q. selects, obtains, configures, and maintains the equipment in the computer lab and keeps the room open from 8 AM until 6 PM daily. Mini-school classes are scheduled into the lab twice a week. P.Q. consults with each teacher about what would be useful activities for that class in the lab that week. While classes are in the computer room, P.Q. tends to act as instructional leader on the technology aspects of the work while the regular classroom teacher offers help on content and helps maintain discipline. When students work in the computer room before and after school they are pretty much on their own unless they ask P.Q. for help. He acts as a consultant when they run into a difficulty or want to try something new.

N.N., a researcher now at a research firm, has worked with P.Q. and the Maynard School on several research projects. N.N. has influenced the school with his ideas about collaborative learning and tool uses of technology. He has been both a knowledgeable colleague and a help in obtaining grant funding.

3.6 Outside Players in Technology Application *[outfield]*

- District involvement ***[distr]***
  Last year the district decided to put integrated learning systems (ILS) in all the elementary schools and P.Q. argued that Maynard should get one even though it already had a large number of computers compared to other district schools. Although not a fan of ILS labs as they are customarily configured and used, P.Q. saw the district initiative as a way to obtain more equipment for the school and he knew enough about network technology and was given enough leeway by the district that he was able to select an open-ended Macintosh-based ILS system and to connect the computers to the same school network serving the Computer Room. (Thus students can have the same kind of access to e-mail and the Internet in the ILS lab that they get in the Computer Room.)

  The district has also supplied a central repair unit that has been useful for hardware problems that P.Q. could not fix himself.

  The city school board has not been a major factor in supporting or shaping the technology innovation although there are city-wide regulations regarding wiring and security. P.Q. was able to get a waiver for the

Computer Room's wiring design. The school board has been an impediment in terms of the amount of bureaucracy, inefficiencies, and delays involved in purchasing hardware or software. P.Q. reports that he spends thousands of dollars of his own money each year because it is easier to do so than to get something ordered and paid for through the school board, even though he has grant funds to cover the purchase.

- State involvement ***[state]***
  State support has not been a major factor. The state's hardware fund has supported the district's computer repair unit. The state provides a small amount of money per pupil for hardware and software.

- Business involvement ***[bus]***
  Panasonic provided an extended equipment loan for a project called Kid Witness News. Students from the Mini-School were involved in videotaping events and editing the video. The project began in 1989. The school was provided with video equipment and was charged with the production of a student news program. Computers are used for script writing and for logging tapes on a data base. Between 15 and 25 students have been involved in the after school project each school year (1993-94 was described as being one of the less active years of the project). The program is run by a public relations firm working on behalf of Panasonic. Panasonic has extended the loan of equipment on a year-to-year basis and the criteria for participation have changed over the years. P.Q. comments that, in past years, the program has provided the Mini School with great exposure. A highlight of the program was the year that the Kid Witness News team visited Washington, DC, during the Saudi Arabia crisis and conducted interviews with Colin Powell and Ron Brown. P.Q. describes the project overall as highly worthwhile, but involving a great deal of support.

  The Mini-School recently received a $1,000 Impact II grant to create a publication on technology use for other teachers. Impact II is a national program funded by a range of corporations.

When the school's connectivity is no longer supported through NSF, continued support will be provided through a Nynex grant to the university's teachers' college. The project is still unfolding, but it will involve the installation of a higher speed data line (an upgrade from the current 56KB line to fiberoptic), which will allow for full-motion interactive video. The school is in the process of planning with the university a September kick-off demonstration. The school connection to Internet will be routed through a university network once the system is installed. In addition to continuing and upgrading the network, the project may also provide a graduate assistant for on-site technical support.

P.Q. notes that there are real advantages to becoming involved in projects that are run through other institutions' grants (e.g., the research firm's NSF and Apple grants, the university's Nynex grant). He views the Earth Lab experience as a positive collaboration in which many of the aspects of grant administration were the responsibility of the research firm, yet P.Q. was kept informed and was included in the decision-making loop. This is an arrangement in which both institutions have much to gain from the involvement of the other.

- Foundation involvement ***[foundtn]***
- Parent involvement ***[parent]***
  Parent involvement has not been at the level the Mini-School would like to see. Parents do have to ask for their children to be accepted in the Mini-School and to agree to certain conditions for their children to be included in the drawing. A letter sent to the parents informing them of the many school options and soliciting applications explains that students will use the computer to help with their regular subjects and will be involved in special projects. Parents whose children attend the Mini-School are asked to support these activities by agreeing "to see that extra work is done, as well as making certain that regular work and activity are taken seriously." The parent letter further states that, "Parents are expected to work closely with teachers to support excellence in achievement." The Mini-School did try an after-school program for parents one year and also experimented with a computer home-loan program for Haitian-Creole parents. The latter

program used the school's older computers and ran into complications because the students did not know how to use the older computers (having gotten accustomed to the newer systems at school).

- Other outside influences, including research
  Through collaboration on a series of grants, N.N. and his ideas concerning the relationship between network technology and collaborative learning environments have been a significant influence on the Mini-School. As the sponsor for these grants, the Applications of Advanced Technologies Program of the National Science Foundation should be considered an influence also.

4.0 Overview of Tech Uses

4.1 Student Uses *[kiduse]*.

The best thing about this innovation is what happens before and after school in the computer lab. One teacher pointed out that if students only use technology during the times their class is scheduled in the lab, that's just two hours a week. But many students, the teacher estimated about half, come regularly before and after school. At such times, some students are working on assignments while others are corresponding with network "pen" pals or playing with game-like software. One afternoon after school, for example we observed:

- A sixth-grade non-mini-school teacher using special software to produce a Kenya banner for the multicultural festival
- A sixth-grade mini-school teacher working with three students on a menu for the Mexican food they would serve at the same festival. They worked on the layout of graphics and text in English and Spanish.
- Three students showing their fourth-grade teacher how to get into her electronic mail on the network.

- Two fifth-grade girls working independently on their country reports on Ireland.

- A boy playing with the *Rainbox* software that was new to the lab and a big hit.

- A sixth-grade teacher consulting with the computer coordinator about whether they could obtain the weather from all their different countries on the day of the multicultural festival.

- Tutorial
  The Mini-School itself does not stress tutorial uses of software. However, they do use a keyboarding program with students and also have a variety of educational games and other tutorial software available. We observed many students using this software on their own initiative before and after school and at lunch time.

- Exploratory
  Although exploratory software is not the Mini-School's main emphasis, there is some available. Students often choose to browse through the Grolier's Multimedia Encyclopedia.

- Communication
  The Mini-School project stresses communication and tool uses of technology. The majority of the school's software resources, including the Grolier's Multimedia Encyclopedia, are available on the school network through the click of an icon. Students also enjoy using electronic mail to send messages to each other, school staff, their pen pals at other institutions, and individuals who can supply information for a given project. For example, during the week we were at Maynard many of the classes were preparing for a multicultural festival. Activities included doing reports on various countries—a fairly standard elementary school task. Although the students started with resources such as the encyclopedia and the almanac, as most students do, they then came into the Computer Room and tried things such as browsing the Internet to find up-to-date information. A number of students in a class focusing on Ireland used TurboGopher to obtain information put on the net by Trinity University in

Dublin. Having obtained the e-mail address of an Irish student, a number of boys were sending messages asking about his favorite sports, conditions in Ireland, etc. After the computer coordinator located an Internet source of international flags, many students were using Mosaic to pull up a full-color display of the flag for their country.

One morning before school we observed a sixth-grade girl, described as one of the most "faithful" participants in computer activities using the C U See Me system developed at Cornell University. This real-time videoconferencing system presents multiple video windows of those logged onto the network and displays messages that they type at the bottom of their video windows (a version that accepts speech input is under development). A camera located near the workstation captured the girl's video image as she worked with the system. Identifying another active user, she sent him a message identifying herself and asking what he was doing. The person at the other end of her message happened to be one of the software programmers at Cornell who was working on the software revisions for the next version of the system. The sixth grader asked him how the next version would be different and then carried on a dialogue about the limitations of the current version. Such a conversation between these two people would not have occurred without network technology.

- Tool

  The Mini-School project stresses tool uses of technology. Word processing and desk-top publishing software are customarily used to produce reports and other products that are considered "important". While we were visiting, students used software for making banners, menus, and information cards for use in their displays for the multicultural festival.

4.2 Teacher Uses *[tchuse].*

- Communication
  Teachers other than P.Q. do not use the communication facilities extensively. However, most of them will use e-mail occasionally, mostly to answer messages from their students.

- Presentation
  Teachers use the computer lab facilities to support their own productivity. During our week at the school we observed teachers coming in after school to work on a variety of things, mostly doing word processing. One teacher not from the Mini-School came in one evening to produce the banner for his class to use in their presentation on Kenya for the multicultural festival. One of the Mini-School teachers used the *Second Voyage of the Mimi* videotapes in her classroom.

- Instructional Management
  Teachers use software for recording attendance. Instructional management software is used by the aide in the ILS but not elsewhere.

5.0 Implementation Details

5.1 Problems Encountered *[probs].*

- Difficulties in selecting hardware/software **[*pick*]**
  Not a problem. P.Q. seems to feel comfortable performing this task and knows where to get the information he needs.

- Difficulties obtaining hardware/software **[*get*]**
  The frustration in obtaining hardware and software has centered around city school board practices. If the Mini-School wants something that is on the approved list for which there is an open contract with the city, things go smoothly. Anything else requires lots of paperwork and follow-up on P.Q.'s part. We observed him trying to get the city to issue a check for a hardware request that had been submitted months earlier. The problem persists even though the school is purchasing the hardware and software from grant money it has obtained. P.Q. reports that he spends several thousand dollars of his own money annually to avoid going through the school board bureaucracy.

- Difficulties maintaining systems **[*work*]**
  Not a problem. The computers have proved to be quite rugged despite lots of hard use. P.Q. manages routine fixes with some help from a graduate assistant and the district has a repair unit that handles more serious problems. We did not observe any problems in this area during our visit.
- Theft/vandalism **[*crime*]**
  Has not been an issue. P.Q. reports that there are some kids he keeps an eye on, but problems have been few. One student used a pencil on a computer once; one VCR and a few mouse balls have been stolen during P.Q.'s tenure as computer coordinator.
- Teacher lack of knowledge/fear **[*block*]**
  P.Q. doesn't see teacher lack of knowledge as an issue. He makes a point not to push teachers into anything they are not comfortable with. When a class is scheduled into the Computer Room, the teacher is present and works with P.Q., but the teacher's role may be primarily one of disciplinarian and content expert while P.Q. is the resource for questions about how to use the software. The extent to which the teachers get involved in helping to plan the details of computer room activities or working on technology issues with their students varies across teachers. One teacher who has been with the Mini-School for two years was described as a computer phobe. After school one day, we observed three students showing her how to get into her electronic mail account. Her willingness to touch the computer to do this was hailed as a great advance by all concerned. (She was able to use this opportunity not only to let the students see her as learner but also to work on their ability to give clear complete verbal directions.)

  At the same time, articulation between what happens in the regular classroom and what happens in the Computer Room would probably be increased if more of the teachers felt an interest in and confidence with technology applications other than word processing. (One teacher is quite interested and others are coming along.)

- Lack of time for learning to use technology or developing technology-related curriculum units ***[notime]***

  Yes. The teachers do not have prep periods and most of them stay in during lunch with all or a subset of their students. There are few in-service days and these are mostly taken up with other activities. Nearly all interviewees concurred that there was little time for in-service training. The district superintendent cited the lack of staff development as one of the biggest flaws of the city school system. Nevertheless, there does not seem to have been any concerted effort to create extra time for working on joint technology-supported curriculum units or on enhancing the teachers' computer skills. Joint planning between the computer teacher and the regular teachers mostly occurs "on the fly" through a brief phone call or short conversation after school. For some kinds of activities this seems to work fine (e.g., students are doing some unit in class and are going to do research or word processing in the computer room) but it does not provide an ideal level of integration across classes and does relatively little to enhance the regular teachers' technology skills.

- Disappointing results from using technology **[*letdown*]**

  Not a problem. Results have been good.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**

  Not a problem. Although there has been relatively little time spent on coordinated curriculum planning, the emphasis on tool and communication uses of technology means that it can fit in with whatever students are studying. Because they are used to technology resources, students will use them even when not instructed to do so by their teachers.

- Lack of funds **[*nofunds*]**

  Not a major impediment thus far because of P.Q.'s success in attracting grants. However, P.Q. notes that it is often difficult to get funds in the areas where they are most needed.

- Resentment from nonparticipating classes/schools **[*green*]**
  In answer to our questions, respondents indicated that there had been some resentment, but it does not appear to have been a major issue.
- Lack of technical support **[*nohack*]**
  Not a problem.
- Failure to see fast positive effects on test scores **[*noshow*]**
  Not a problem.
- Other **[*bug*]**
  The Mini-School teachers note that their collaboration has sometimes been marked by conflict. Several said that there is not as much collaboration among teachers as they had hoped—but they are quick to note that it is a lot better than in the regular school. There is also concern over the ability of the innovation to become institutionalized. Both P.Q. and several of the senior teachers are nearing retirement. These individuals put far more time and energy into the Mini-School than is required by any contract. The program will need a leader who can assume responsibility for the technology aspects of the program and also pull the teachers together.

5.2 Strategies for Overcoming Barriers *[solve].*

- Inservice training/release time
  Not used to any great extent.
- Involvement of outside experts
  N.N. (formerly at a teachers' college, currently at a research firm) has been instrumental in shaping the philosophical and pedagogical approach to technology use within the Mini School. J.K. (at the teachers' college) has also been a major influence in shaping and supporting the use of technology at the school, especially in the areas of working with parents and developing computer-supported programs to support ESL student's writing and language development. J.K. has brought many of her graduate students into the school for project work. C.C.'s' (at the teacher's college) approach to reading instruction is the model upon which the literacy program within K.T. and A.P.'s classroom is based.

- Creative fund raising
  The computer teacher/project director has been quite successful in raising funds to obtain technology resources for the school. The Mini-School teachers have shown an interest in working with outside researchers, not only the two technology projects with N.N. described above, but also the literacy process project with the university and, earlier, serving as a test site for the Second Voyage of the Mimi courseware. The project director has also been astute about making the connections and attracting the kind of attention that have provided opportunities for the school.

- Other
  The Mini-School staff make the time for doing many of the things necessary to hold the school together by working extra hours. Although school ends at 3 o'clock, many of the Mini-School teachers and the computer coordinator are there until 6 o'clock every night. An unusually large proportion of the students chose to stay after school as well, working not only in the Computer Room but also in a number of the regular classrooms that stayed open so students could work on their projects.

5.3 Facilitators *[facil]*.

- Technical support on hardware/software ***[techta]***
  P.Q. is very knowledgeable about computer hardware and network and tool software. In addition, the collaboration with a local teachers' college and a research firm gave P.Q. a chance to work with outside experts in network systems and software development.

- Teaching skills (nontechnology) ***[haveskl]***
  The Mini-School teachers were selected with an eye toward the extent to which they were already doing innovative, student-centered work in their classrooms.

- Technical assistance on integrating technology into instruction ***[instrta]***
  Working with N.N. on the Earth Lab and testbed projects helped P.Q. clarify his ideas about what computer technology could do for students and how it needed to be structured to obtain those benefits.

- Supported time for teachers to develop skills ***[timesupp]***
  Not available.

- Other

5.4 Costs *[costs]*

P.Q. estimates that setting up a school network with a server, Internet connection, and 35 Macintosh computers would cost on the order of $1,500 to $1,800 per machine ($52,000 to 60,000 for the lab). In addition the lease line costs $15,000 a year (but the same service is less expensive in many parts of the country). The server with software costs about $10,000 (including $5,000 for the hardware, $1,450 for support for a server). The school spends about $2,500 a year on repair and maintenance.

6.0 Impacts [impact]

6.1 Effects on Students *[kidout]*.

The principal pointed out that the Computer Mini-School students typically do well in inter-school competitions, such as poetry contests and science fairs.

- Motivation ***[motiv]***
  The technical report by N.N., P.Q., and a third colleague argues that the "fundamental change" at the Mini-School is a "greater sense of community and emotional belonging". Although the technology was only one part of this change (smaller classrooms and the teachers' commitment being major factors), it was clear that students enjoy working at the technology and the Computer Room becomes a focal point for before and after school activities that often include working on classroom assignments. It was striking to see so many students staying as much as three hours after school by choice. Although game-like software was a draw for many, there was also a great deal of work extending class projects. Some of the work seemed to address fulfilling requirements, but other activities went beyond them (e.g., initiating an e-mail correspondence with someone from the country under study).

- Self-esteem ***[kidestm]***

  The students at the Mini-School show a great pride in their work and are eager to describe it to visitors. This pride extends beyond but certainly encompasses their technology-supported work. The bulletin boards in the hall, for example, display student poems on selected themes. The art work is typically hand done but the poems have been edited on computer and produced on a laser printer.

- Attendance, retention, disciplinary rates ***[kidbehav]***

  The school does not keep separate statistics for the Mini-School. From interviews and brief observations of other parts of the school, our sense was that there are fewer disciplinary incidents in the Mini-School. The principal said that behavior was better in the Mini-School. The Mini-School has a policy of not retaining students. Attendance for the school as a whole has run at 87-89% for the last three years (compared to 85-86% for the district). From SY1990-91 through SY1992-93, the percentage of students at Maynard for at least 3 years was 73% (compared to a mean of 59% for all district elementary schools).

- Technology skills ***[hackskl]***

  The Mini-School students are very comfortable sitting down at a computer and getting into electronic mail, opening a word processing program, etc. They are not afraid to try—or even demo to a visiting adult—a piece of software they have not personally used before. When students get stuck, they tend to ask a neighboring student for help, and if that doesn't work to appeal to the computer coordinator. One teacher made the point that Mini-School students know more about computers than do other students when they reach junior high.

6.2 Effects on Teachers *[tchout]*.

- Inclination to assign complex tasks ***[hardtask]***

  Teachers did not mention more complex assignments inspired by the availability of technology.

- New instructional strategies ***[tchstrat]***
  The teachers who came together to form the Mini-School tended to be those who were interested in trying some new things and in doing more student-centered project-based teaching. Being in the Mini-School has probably reinforced this tendency although several teachers made the point that they have not changed their teaching approach, they have just found a place where it is approved rather than discouraged.

- Self-esteem and sense of professionalism ***[tchach]***
  With the exception of one of the teachers, involvement with technology did not appear to be a major enhancer of their sense of self-esteem. Most seem to get a greater sense of pride from their ability to handle the challenges they (and their students) face in the regular classroom.

- Communication with other teachers ***[tchtalk]***
  Teachers are not making much use of the technology resources to communicate with other teachers with the exception of P.Q., who has become quite active in educational technology and network education circles, currently serving on the Board of Directors for CoSN, for example. P.Q. reports receiving about 20 messages on the network a day, most of which come from outside the school.

- Use of their time ***[timeuse]***
  A major part of the innovation concept was a redistribution of teachers' time. They gave up a prep period, which many of them felt was too short to do anything significant, in order to obtain a smaller class. In addition, the ethic of the Mini-School is one of long hours for teachers. Many of the teachers stay after school for two or more hours during which time they are not only performing their own tasks of planning and grading but making themselves available to students who have also chosen to stay late. The after-school camaraderie and informal learning and coaching was one of the most impressive aspects of the Mini-School.

6.3 Effects on School Climate & Processes *[schout]*

- Increased linkages with outside organizations, resources ***[link]***
  The project has brought Maynard a great deal of positive attention. The school gets 4-5 visitors a week, and was recently visited by the Chairman

of the FCC. The school was featured in an article in *Fortune* magazine and more recently in a piece in the newspaper.

- Enhanced role as magnet ***[magnet]***
  Although we did not hear about students trying to transfer into Maynard from other parts of the district or city, the Mini-School has certainly become a draw within the school. Last year there were two applicants for every fourth-grade opening.

6.4 External Accountability Measures & Their Influence *[account]*

After its first year of operation, students in the Computer Mini-School performed better on standardized tests than did Maynard students as a whole. This finding surprised the project staff somewhat because the program had not been designed to stress the kind of material found on the standardized tests. An important effect of this outcome in a city system that stresses test scores has been a good reputation and continued backing from the district administration.

6.5 Evaluation *[eval]*

- Test scores
  N.N., H.H., and P.Q. compared the amount of improvement in standardized test scores between 1990 and 1991 for students in the Computer Mini-School compared to other Maynard students. The gains were larger for Mini-School students on all four of the tests. In terms of percentiles, the improvement of Mini-School students was 8.7 to 10.6 percentile points larger than the gain for students in other classes on the three math tests (all significant differences). The Mini-School students gained 2.9 percentile points more than their counterparts in the regular classes on the reading test, a difference that was not statistically different. The analysts attempted to control for differences in background variables, but it should be noted that although students are not selected for the Mini-School on the basis of ability, only students whose parents are interested enough to complete the application form and sign the pledge participate in the drawing for Mini-School places.

Because the Mini-School is a complex intervention, it is not possible to attribute these positive results to any one variable. The researchers themselves believe that the gains resulted from "the greater sense of community and emotional belonging that became possible with the smaller class size" (p. 9) and only indirectly from technology, by virtue of its contributions to collaborative activities and a sense of community.

More recent test scores on Mini-School students separately were not available at the time of our site visit. We were able to obtain 1992 and 1993 standardized test score data for Maynard students as a whole and compare them to the averages for the entire district: Maynard students average better than the district mean, particularly on measures that are administered to general education students only (excluding special education and LEP).

- Retention rates
  The Mini-School has a general policy of not retaining students. Criteria are based on standardized test scores. If scores are below a certain level, promotion depends on the student's participation in summer school.
- Attendance
  Attendance for the school has averaged between 87 and 89% over the last three years, compared to averages between 85 and 86.4% for the district as a whole. Data are not maintained for Mini-School students separately.
- Discipline rates
  Interviewees report that there are fewer disciplinary problems within the Mini-School than in the school as a whole and our observations over the week would support this. During the duration on an hour interview with the principal, there were several incidents of fighting of a nature not observed during over 30 hours in the Mini-School area.

- Teacher turnover
  Teacher turnover within the Mini-School is reported to be lower than for the rest of the school. Only two teachers have left the Mini-School, one for pregnancy and one to return to the regular school.

7.0 Reflection and Advice

7.1 Dissemination *[spread]*

Elements of the Computer Mini-School innovation have been used elsewhere but there is nothing resembling the same package. More specifically, the school decided to repeat the staffing pattern and strategy of trading release time for smaller classes in developing a science mini-school this year. In addition, P.Q. has helped to set up a network and some activities at a nearby junior high as part of a leadership project funded by Apple. This involved assisting with the purchase and setting up of equipment, identifying and training an individual to provide on-site network management and technical support, and training a junior high student to provide further technical assistance. P.Q. comments that the technical aspects of the program at the junior high have gone well, but the program has not blossomed due to the fact that the students do not have a high level of access, which is one of the strongest features of the program at Maynard (the junior high lab is open to students during limited hours). P.Q. comments that "the key to success is access."

When asked how to replicate this kind of program, a district administrator said "Find another P.Q." There is concern that P.Q.'s combination of technical know-how and instructional philosophy is hard to replicate and will be difficult to replace when P.Q. retires several years from now.

Descriptions of Mini-School activities have appeared in newspaper and *Fortune* articles. P.Q. and a number of students have participated in national conferences on technology and education.

7.2 Plans *[plans]*

During our site visit, P.Q. was concerned most urgently with finding a replacement for the funding the program has received through N.N.'s NSF grant. When this ceases in the fall of '94, another source of funds is needed to keep the network activities going. Following our site visit, P.Q. received the news that the funding for connectivity (and upgrading of the line) will be covered through a Nynex grant to the nearby university's teachers' college.

P.Q. is concerned that plans be made for replacing him and keeping the technology thrust of the Mini-School going after his retirement (scheduled for two years hence). None of the classroom teachers appears to have shown an inclination to take on this role.

Another point P.Q. makes is that he would like to see the innovation institutionalized. The city board of education has supported networking for administrators. P.Q. would like to see more support for instructional networking.

Secondarily, P.Q. feels that the Mini-School needs to develop an acceptable use policy. No formal policy exists at present and although there have not been major problems, P.Q. feels the issue needs to be addressed. Occasionally students do use the network to send each other insulting messages, but judging from observations during our week at the school, these are exceptions to typical behavior and are treated seriously and handled by the teaching staff.

The district superintendent said that he would like to make the Mini-School more accessible to special education and bilingual Haitian students.

7.3 Advice *[advice]*

The principal advises being supportive of innovators, providing them with resources. Also, she cautions that you can't judge an innovation during the first year, when there are bound to be problems. Administrators need to protect innovations for a long enough interval to fairly judge their success.

P.Q. cautioned that you want to avoid making claims that are too grand and getting too much attention in the beginning. It is hard to develop an innovation and to collaborate "in a fishbowl". He acknowledges that the Mini-School has had its share of disagreements and personality conflicts, but they have not had the kind of scrutiny that made such difficulties public knowledge (in contrast to another technology school he has visited). On the other hand, once an innovation is well established, favorable publicity can do much to endear a program to district and city administrators. P.Q. believes that the program's presentation in the media (e.g., *Fortune* and newspaper articles) and recognition in political circles (P.Q.'s invitation to the technology conference at the White House, visit of FCC chairman) have done much for the Mini-School.

P.Q. also stresses the importance of making technology available to students for substantial amounts of time: *"The key to success is access."*

CLASSROOM LEVEL DEBRIEFING FORM

Short Title: Team Teaching in the Computer Mini-School

Teacher: K.T. (6th grade) and A.P. (5th grade)

Site: Maynard Elementary: Computer Mini-School

1.0 Summary [*sum*]

A.P. and K.T. team teach their 5th and 6th grade classrooms within the Computer Mini-School. They place a strong emphasis on student-centered, collaborative learning. Students spend the majority of their school days working in small groups (e.g., Reading Clubs, writing conferences, project work and research), interspersed with teacher- or student-led "mini-lessons." In addition to their twice weekly scheduled visits to the computer lab, students make regular and ongoing use of the lab for their group and individual writing and research projects. Large-group computer sessions focus on LOGO and math-related activities. Students access Internet to gather information from outside resources when conducting research. They communicate with individuals in distant locations over the network, both as pen pals and for research purposes. They use the word processor as a writing and publication tool. When preparing presentations, they create graphics and scan images for inclusion in their final products. In addition to their flexible use of the lab throughout the school day, many students come early or stay after school in order to conduct these activities.

2.0 Classroom Context [*context*]

There are 44 students in the 5th/6th combined classes.

K.T. has taught at Maynard for 6 years. Prior to this, she taught kindergarten in a private school. While teaching in the private school, she earned her master's and received her public school certification. Her first class at Maynard was a 5th grade class of 38 students, with a large number of boys who had been held behind. K.T. found that "everything I had done in the private school didn't work" with this group of students. She became a more traditional teacher, in part due to the discipline issues that arose in this context. In her second year at Maynard, K.T. taught a class of 36 students who were all functioning below grade level. When the opportunity arose to become a part of the Mini-School, K.T. was attracted primarily because of the smaller student numbers. She also was interested in having the opportunity to work in collaboration with other teachers, as she had felt very isolated in the regular school. Technology was not one of the features that attracted her to the program, primarily because she had not had the opportunity prior to coming into the Mini-School to "see what it could do." Since being in the Mini-School, K.T. has grown to appreciate the role of technology in the context of her students' activities and projects. However, she rarely uses it for her own purposes other than as a word processor. When she is interested in learning something new about a computer application, she typically gets the information needed from one of her students.

A.P. worked in publishing and advertising prior to coming to Maynard as a cluster teacher four years ago. She became interested in teaching as a writer and earned her master's as a secondary English teacher. Her background in writing and her familiarity with word processing/publishing software led to her role as the cluster writing teacher in the Apple IIe computer lab at Maynard. She worked with groups of students from the regular program, with each class attending the lab twice a week on a rotational basis. A.P. became frustrated with the arrangement because there was no coordination or continuity between what she was doing and what was happening in the children's classrooms. She was unable to do much with the process approach to writing given the short amount of contact with the students and the fact that they were not engaging in process writing at other times of the week. After two years as the cluster teacher, she heard that there were openings in the Computer Mini-School and she expressed interest. She and E.C. joined the six other Mini-School teachers at the start of the 1992-93 school year. A.P. was attracted to the program because of the flexibility she felt that she would have to implement her ideas, the possibility of collaborating with other teachers, and the smaller class sizes. She also felt that the teachers within Mini-School were especially dedicated; that they took their work more seriously than most of the teachers in the regular school and she wanted to be identified with this community. Computer access was not a major impetus, because she felt that she could use the computers in the writing lab as a regular teacher. However, the flexibility of access, with the Mini-School lab available throughout the day for student use, was appealing.

Both K.T. and A.P. express disappointment and frustration with the lack of collaboration among teachers in the Mini-School. They state that most of the teachers are traditional in comparison with themselves and that there is a general feeling of independence and ownership of individual classrooms, with little interest in group planning or coordination of curriculum. Monthly meetings are often canceled and those that are held are often precipitated by a crisis situation (usually involving student behavior) that becomes the focus of the gathering. When joint decisions are made, there is often a great deal of debate. K.T. notes that this can be a positive process, in that each teacher is forced to articulate her/his philosophy and to think through the reasons why she/he is recommending a particular approach. In general, however, teachers within Mini-School plan and implement their curricula independently of one another. There is, however, an overall sense of identification with the Mini-School faculty as separate from the regular school. This appears to be derived from the high level of dedication and sense of professionalism among the Mini-School staff.

As teachers with similar approaches, A.P. and K.T. shared ideas informally throughout the 1992-93 school year. At the onset of the 1993-94 school year, an asbestos crisis led to the closing of classrooms and the decision on the part of the two teachers to share one large classroom. The arrangement worked out so well that they decided to continue team teaching when another classroom opened up. The second smaller classroom is used as an annex for smaller group activities or for periods when the 5th and 6th grades meet separately.

K.T. and A.P. appear to complement one another in a number of ways. K.T. is strong in social studies and reading, while A.P. is especially strong in writing. K.T. took a course in collaborative learning in the Fall, sharing what she had learned with A.P. A.P. appears to regard K.T. as a mentor who has helped her realize how to apply the approaches that she understood from a theoretical perspective, while lacking training in the "nitty gritty" of classroom implementation. Both teachers value what the other brings to the mix and both identify themselves as a members of "a community of learners," rather than as knowledge givers whose role it is to tell their students what they need to know. Both teachers are comfortable with the fact that many of their students are generally more proficient at the computers than they are, and they point to the students as their primary teachers in this arena.

K.T. and A.P. have both done graduate work at the nearby university's teachers college and have studied the writing and reading process approach to literacy instruction with a faculty member there (C.C.). Because of their work in this area, the two teachers were nominated into a special reading process program with C.C., who is gathering data for a new book. Twenty five teachers are participating in the project altogether. They meet on a regular basis to discuss and share their classroom reading programs. C.C. has visited K.T. and A.P.'s classroom on several occasions, providing valued insight and support. A researcher visits their classroom as a participant observer to assist and collect data once every few weeks. In addition to the feedback and assistance they have received, K.T. and A.P. have gained recognition for their work and they have found an avenue for collaboration with other teachers through their participation in the project.

3.0 Reform Features [*feature*]

Y Interdisciplinary
Y Project-based
Y Collaborative Learning
Y Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach

4.0 Description of Activity [*activity*]

The Curriculum. K.T. and A.P. have implemented a curriculum that is theme-oriented and project-based. Grade-level outcomes are integrated into the ongoing projects. Many projects are interdisciplinary in that they involve reading, writing, research, and artful presentations. Projects vary in duration, as well as in terms of how much of the school day gets devoted to them. During the week of our visitation, a significant portion of each day was focused on the study of the Irish culture (e.g., art, music, history, folklore). This project was conducted in coordination with the all-school multicultural fest, which was to culminate in a sharing of presentations and displays at the end of the week. K.T. explains that the class schedule is flexibly structured around projects such as these. Both teachers estimate that 90% of the school day is spent in collaborative groups, focusing either on project work (typically research studies in science or social studies), writing conferencing, or Reading Clubs.

During the first part of the school year, a great deal of time and energy is devoted to helping students learn the collaborative process. The teachers describe this as a difficult challenge for the students who are used to traditional classrooms and have not previously been socialized in this manner. They introduce the concept of group work through mini-lessons, modeling, and ongoing teacher-facilitated reflection and discussion.

At the beginning of the school year, the class conducts large-group projects in which individual students take on different roles. The students divide responsibilities based upon individual interests and skills. They spend a lot of time arguing and as conflict arises, the teachers bring the students together to discuss what has occurred and why. Students are encouraged to offer their suggestions. Sometimes students are given formal roles as mediators or facilitators. Throughout this initial period, the dynamics between group members and the strategies for conflict avoidance and resolution are made explicit through a group problem solving process. Students are asked to keep a log about who they have worked with, and why they would like or not like to work with those particular individuals again. (K.T. comments that after a few months, they often find that the person they were unable to work with initially is someone that they are able to work with at a later point.) Students view their collaborative work on videotape, which provides further opportunity for reflection and problem solving. Throughout this process of structured reflection, the teachers act as facilitators and coaches to support the development of collaborative group work.

The reading curriculum, which is organized around Reading Clubs, provides a rich illustration of how the collaborative process is supported in K.T. and A.P.'s classroom. From September to October, the students engage in independent reading and they conference individually with the teachers. During this period, the reading conference is being modeled for the students. The students then begin to conference with one another. Announcements are posted for groups to meet and discuss books that focus on common topics (teenagers, mysteries). The groups meet for a few days at a time, then disperse and regroup around different topics. During this period, students who are reading the same book begin reading together as "study buddies." This independent reading program, with ongoing short-term groupings and pairings continues through November. At this point, students are paired for 3 to 5 day periods to read and discuss a series of short stories. They progress from pairs to triads to quads, all the while keeping notes about who they have worked with. They study poetry in groups of 4 to 5 students. In December, they begin discussing the organization of Reading Clubs (reviewing their notes on who they have worked with, considering who would help them become a better reader and listing the desired attributes of group members). In January, students write interview questions and conduct interviews with candidate Reading Club members. After completing their rounds of interviews, they draw up invitations for those individuals who have met their criteria for membership. Each student goes through his or her invitations and meets with the club s/he is interested in joining. After two days of engaging in this student-centered selection process, the children settle into their groups. K.T. is proud to point out that most of the groups emerging from this process are of mixed gender and heterogeneous in abilities.

The Reading Clubs form their own agendas, assign themselves homework, and monitor one another's work. They meet daily to engage in alternating activities: reading aloud and pausing between pages to comment and reflect (a process called "say something"); reading silently and pausing to respond. They ask clarifying questions, make inferences and predictions, relate the issues encountered in the books to their ideas about the world and to critical issues in their own lives. During the Reading Club meeting period, teachers circulate the room, pausing to listen in on individual groups and to offer suggestions or ask challenging questions.

The solid foundation of collaborative group work that is gradually established through the Reading Clubs is extended into all other areas of the curriculum. Within social studies and science, students conduct research projects in small, self-selected groups. Their research projects culminate in a presentation period, during which students share what they have learned and spend several days "processing and responding" to one another's presentations in structured-response groups. After presenting their projects on famous individuals, for example, students gathered together in groups to identify and examine different lines of inquiry (e.g., what made these individuals famous, what were their primary life influences, how did they help their country). Through this process, the students discover common themes (e.g., for many individuals, something terrible happened to them that made them ride to the top). Most project groupings are mixed in terms of gender, abilities, and age. Math is one of the few areas in which the 5th and 6th grade students separate for targeted grade level instruction with their teachers. Mini lessons are followed with collaborative hands on application and problem solving activities. Twice weekly, the students engage in large group math oriented LOGO activities in the Computer Room.

Technology is used across the curriculum in a variety of ways. In addition to LOGO, students utilize the Computer Rom for word processing, research, and the preparation of presentations (banners, graphics, etc.). Throughout large blocks of the school day, students move freely from the classroom to the lab individually, in pairs, and in small groups. During the week of our visitation, students were involved in preparing reports and displays on Ireland for the all-school multicultural fest. In the classroom, groups of students were working in clusters throughout the room on projects focusing on different aspects of the Irish culture. A group of five students was creating homemade bagpipes and penny whistles while listening to a tape of the music of the Irish Rovers. A pair of students was sketching a large detailed map of Ireland. A group working on posters about Irish folklore sent several students to the lab to gather information from the on-line encyclopedia and to scan pictures of leprechauns. Another pair of students working in the lab was able to access Trinity College in Ireland over the Internet using the Turbo Gopher. They used this resource to communicate with college students about their country and to gather information on historical artifacts through the college's database. When the Computer Room was not in use for whole class instruction, it functioned as an extension of the classroom in this manner. K.T. and A.P. described this integrated use of the lab as typical of many projects.

As we observed the unfolding events in preparation for the multicultural fest, we were impressed with the high level of collaboration among students, as well as the independence with which students were able to identify and carry out relevant uses of the resources within the Computer Room. Searching for information on-line appeared to be as natural an activity (and perhaps even more so) as looking up information in a book. The students exhibited a real understanding of the availability of a range of resources, both human and artifactual, available via the computer. The notion that they might put out a request over the Internet and in response, link up with individuals who could provide useful perspectives, appeared to be quite familiar to them. K.T. and A.P. both commented that this activity has made the information gathered "more real" to the students than textbook derived knowledge could ever be. According to their teachers, email exchanges with human resources in particular has given the students a stronger sense of the issues and information being studied.

5.0 Technologies Involved [*types*]:

Y	Microcomputers
Y	Word processing
N	ILS
N	Spreadsheet
Y	Other LANs
N	Hypermedia
Y	WANs
N	Animation
Y	CD-ROM
N	Simulation
N	Interactive videodisc
Y	Videocams and editing equipment
	Other

Note: The classroom is equipped with a single Mac, but it is rarely in use. K.T. states that this is because students find it too slow (older model) and prefer working in groups in the lab. Given their flexible access to the lab, which is just down the hall, this arrangement works well. The lab is equipped with 35 computers linked on a local and wide area network, giving students direct access to Internet. Students use the lab for word processing, research, email, and group math activities (LOGO). Students have used videocameras to tape student projects and the group process.

6.0 Technology Use

- Student Uses [***kiduse***]

Tutorial ***[tutor]***
K.T. comments that she has no interest in using tutorial or drill and practice software, which she characterizes as "glorified workbooks." She encourages her students to use tools and more open ended software. Instructional games are available on the file server in the lab and are popular with some of the students (Math Blaster).

Exploratory ***[explore]***

A variety of exploratory software is available for independent use by students. Students use the Grolier Multimedia Encyclopedia and other on-line information resources when conducting research projects. Simulations such as Oregon Trail are popular. The students participate in LOGO classes two times a week, exploring math concepts through "turtle geometry" (programming the computer to create geometric shapes). Using Turbo Gopher, the students can explore a wide array of resources (e.g., university databases, weather simulations, whale tracking software) available on the Internet.

Communication ***[commtn]***

Each student within the Computer Mini-School has his or her own email account. Many of the students communicate with pen pals in distant locations. Within the context of their project work, students gather information from expert sources over the Internet. For example, a group of students conducting research on whales decided to post a request for information on the Internet. K.T. reports that the response was overwhelming. Students were able to ask questions directly of individuals who worked in the field of marine biology. They were directed to an on-line whale program that enabled them to listen to the sounds of whales and to track their migratory patterns. On another occasion, students studying Ireland interviewed college students attending Trinity College in Ireland over the Internet. K.T. commented that this opportunity for direct exchange is much more stimulating and "real" to the students than gathering information from a textbook.

Several of the students in K.T. and A.P. class have explored a recently installed communication system called "C U See Me." The program is still in development and Maynard is a testbed site. In addition to exchanging real time written messages, digitized video and audio support allows participants to see and hear one another. During one of our observations, G.H., a 12-year-old student in K.T. and A.P.'s class who spends many after-school sessions in the Computer Room, exchanged messages with one of the C U See Me developers at Cornell University. She asked the developer what he was doing and he explained that he was working on the next version of C U See Me. Their on-line conversation went on to discuss the limitations of the current system (e.g., the audio does not work most of the time) and how that was being addressed. On a separate occasion, another student exchanged messages with a group of students at an elementary school in Washington, D.C. Their conversation consisted of introductory remarks and questions about their respective schools and the local weather. The exchange was punctuated with frequent hand waving and broad smiles. At this stage, the system is used for informal exchanges and has not been integrated with classroom curriculum. The opportunity for audio and video-supported communication between multiple distant locations in real time appears to have real potential for extending the benefits of on-line communication in the near future (e.g., allowing children to "visit" one another's classrooms, to view each others' project work, to demonstrate as well as describe).

Tool ***[tool]***

The computer is used most extensively as a tool by the students in K.T. and A.P.'s classroom. While most students compose their initial drafts using pencil and paper, the word processor is used for later drafts and for final publishing. Other products, such as banners and graphics used in project presentations, are often created at the computer. During the multicultural fest, students incorporated scanned images, word-processed texts, and computer graphics into their posters depicting various aspects of the Irish culture.

K.T. on writing and the computer: *A lot of the kids don't work on it at home, but use the Computer Room time because they can think and compose much better at the computer. Other kids prefer paper and pencil, but publish at the computer because it looks nicer, they can check their spelling, and they don't have to recopy it. Other students...their motor skills are so poor, it makes them feel that their piece of paper doesn't look so awful all the time. It's a small little thing, but it's a really big thing to the children who don't want to hand something in because they feel that it looks awful...Your thoughts and ideas are there neatly presented. There is one child who always types what he hands in...a number of students will use their parents' old typewriters to type what they hand in just because they think it will make it look nicer. Then when they have to retype it, they say, "Oh I should have done it on the computer, I'd be saved!"*

- Teacher Uses **[*tchuse*]**

  K.T. and A.P. both report that they use the computer primarily as a word processor. They comment that students know much more about other computer applications than they.

  Communication

  K.T. comments that she uses the computer to communicate with students if they email her first, but that it is not a regular vehicle for communication. During the 1992-93 school year, her class was linked to another over the Internet and she exchanged messages with the other participating teacher. This was described as an unsatisfactory experience however, because the other class had less access to computers and their responses were irregular. K.T. occasionally makes announcements to Computer Mini-School teachers over e-mail, but more typically uses hard-copy memos.

  Presentation

  Both teachers use the computer as a word processor, to prepare materials for students and parents. The video cameras have been used as presentation tools, to demonstrate student activities and projects to parents and to allow students to view and reflect upon their group collaboration process. K.T. collected over 20 hours of video tape of student collaboration for a graduate class and some of these tapes were used with the students. Students viewed these tapes with their teachers and used them as a springboard for discussion about the group process (what happened, what worked, what didn't, viewing changes over time).

  Instructional Management

  Not regularly. K.T. mentioned that she put student test scores into a database at one time.

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration

  Yes. The development of group collaboration skills is a major focus of the instructional approach within K.T.'s and A.P.'s classrooms. The computers are viewed as another opportunity for collaboration. Students are encouraged to work in pairs during LOGO activities and when conducting research at the computers.

- Independent exploration

  Yes. Students are encouraged to utilize the Computers Room on a self-selected basis, as a resource for exploring and gathering information within the context of their project activities. Students who visit the Computer Room before or after school are free to explore a wide range of programs.

- Access to outside information resources

  Yes. Through the Computer Room's connection to the Internet, students are provided with rich opportunities for access to outside information resources. The use of these resources is actively encouraged by the teachers, who feel that students will gain a better sense of information when they are directly linked with expert sources.

- Support for higher-level thinking

  Yes. K.T. believes that particular uses of the computer (e.g., tool as opposed to tutorial) promote problem solving and critical thinking skills on the part of students.

- Creativity

  Not mentioned, but appears to be valued and nurtured in the classroom. Self expression in writing and in visual arts is encouraged at the computer as in other media.

- Technology skills

  Yes. The teachers feel that technology skills will be required of their students in the future, and that the acquisition of these skills at this grade level gives them an advantage.

8.0 Realized Benefits of Technology *[kidout]*

- Motivation ***[motiv]***

  It was clear throughout our site visit that students at Maynard take a great deal of pride in what they are able to accomplish at the computer. Students were eager and excited to demonstrate their computer skills and to share their work files with us. A major indicator of motivation is the fact that the Computer Room is frequented by students on a self-selected basis before and after school, during lunch, as well as during regular school hours. While instructional games and arcade-like programs garner their share of attention, a great deal of self-selected student computer use is related to project work, especially in classes such as K.T. and A.P.'s where the curriculum is organized around project-based activities. Within this context, the use of the word processor and graphics tools for the preparation of materials and the use of on-line resources for research, appeals to students. Students comment that using the computer for these purposes makes them feel special, important, or, as one 5th grader put it, "more responsible." Many students are aware of the fact that their computer skills are more advanced than those of many of the adults in their lives, and that they have a level of access to computers not often experienced by other students their own age. This awareness appeared to contribute to their sense of efficacy as learners.

  The use of the computer as a writing tool appears to contribute to student interest in writing in general, and in particular, in their interest in the publication aspects of this activity. Both A.P. and K.T. feel that the students like the professional look of the writing they produce at the computer. This is regarded as a source of motivation and pride in their writing.

  A.P.: *For some of them it makes them feel like they're finished. It looks really good–better than if they had done it with handwriting. It looks professional. In that respect, the final thing...I know that feeling myself...it puts a new luster on things. I think that if they didn't have that, they would not feel so big or so professional...that they have gone through everything that a real writer does...actually published. To have it published at the computer and typed up like that is more than if they had just done it by hand. It's like the difference between third and fifth grade...the difference between a typed term paper and a handwritten one.*

- Attendance, time on task, discipline ***[kidbehav]***

  K.T. feels that the computer has a focusing and often calming effect on students that are having behavioral difficulties. In this sense, she feels that the use of the computer may circumvent some of the discipline issues that might otherwise arise.

  K.T.: *The Computer Room is a place where a lot of the kids, if they are having trouble with their behavior or emotions, they will ask to go to ...I think it soothes them and there is no pressure. When I started learning in college, I felt intense pressure, but it's is different for them....It focuses them off whatever was bothering them and gets them back on track. I think that this is an aspect that people have not looked into enough, that it can take a child who is very unfocused and having distress in the classroom, and you can see them...they are not breathing heavy any more...even just logging on...I don't think that it could be any activity...5th and 6th grade is a time where students are having a difficult time with their emotions...When they see that this is an option, and they can handle this option, and it is always an option...they can go in and calm down and get themselves together.*

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  Students often choose to work at computers in pairs and in small groups, especially when conducting on-line research. Even when involved in individual activities, the side-by-side arrangement of the workstations makes it easy for students to take an interest in and assist in one another's work. The legibility of text on screen has supported collaboration in writing, both at the level of the process of composition and product sharing and feedback. K.T. feels that the high level of collaboration that occurs at the computer, is to a large degree, a reflection of the instructional support of the collaborative process within the classroom. At the same time, the computer provides a context in which collaboration is eased and supported.

- Ability to manage own learning ***[selfreg]***

  Self regulation on the part of students is facilitated within K.T. and A.P.'s classroom at multiple levels. Through activities such as the Reading Clubs, writing conferences, and group project work, students are given the tools and the responsibility to manage many aspects of their own learning. When students request information of their teachers, they are frequently encouraged to engage in an independent or peer-supported search for the information needed. In this way, K.T. and A.P. hope to reinforce the independent, rather than teacher-dependent, learning skills of the students. The computers are viewed as an extension of this general approach. K.T. states that she feels that tool uses of the computer in particular "give children the opportunity to come up with their own ways of using it for themselves." Students utilize the lab in a self initiated manner, making independent choices about when and how to integrate the available tools and resources within their writing and project-related activities. The computer coordinator, P.Q., has configured the system in such a way that students are able to enter and access their files and on-line resources with a great deal of ease and independence (see School Debriefing Form for description of configuration). A high level of access to the lab through the school day, coupled for many students with self-selected use before and/or after school, has fostered familiarity and proficiency with respect to many computer applications and related skills. Given this level of access and support, the Computer Room provides a context in which students are able to manage their own learning activities.

- Access to outside information resources ***[outinfo]***

With it's high-speed data line, Internet server, and user friendly network user interface, the Mini-School's computer lab is well equipped for providing students with quick and easy access to outside information resources. The students make extensive use of this capability, both for personal communication and for project related activities. Every student has his or her own electronic mail account. When conducting research, students search on-line resources for information. They post email requests for information and receive responses from experts in the field being studied. They access databases at colleges and universities, as well as other outside resources. During their preparations for the multicultural fest, students interviewed Irish college students about what it was like to live in Ireland (e.g., their work, sports, the climate). They gathered historical information through a database at Trinity College accessed through the Internet. During another project focusing on the study of whales, students communicated with marine biologists over the Internet and were directed to an on-line program that allowed them to listen to whale sounds and to track their migratory patterns. K.T. feels that these opportunities provide students with a stronger sense of the information being gathered, because it is connected to real people, places, and events and it is presented from more than a single perspective or modality.

> K.T.: *There is a group of students studying the behavior of whales, they put on the wire that they were interested in finding out more and within an hour they went back to check their mail; they were so excited. They got responses from really top people. They were amazed and so was I.*
>
> *We're also doing Ireland for our multicultural fest and the kids were able to contact Trinity College in Ireland and ask for information from college students...It makes kids realize that information is happening right now and it's not just in a textbook. And textbooks can be wrong. And there's always a perspective on a textbook...let's get it from someone who is really living there instead of from a textbook. Sometimes children in this city are very isolated because they don't get to go very many places. But through this communication over the computer, they are able to realize that Ireland is just not a place on a map, but there are people living there. Through email they are able to get a response. A lot of them have pen pals all over the world.*

- Support for higher-level thinking ***[higher]***
  Computer lab activities in the Mini-School are rich in opportunities for the development of higher-level thinking skills. Students use the computers to engage in written composition, meaningful communication with outside sources, mathematical problem solving (e.g., LOGO), critical reading, and information searches (e.g., research). The skills involved in orchestrating the use of a range of computer applications and on-line resources in concert with their project goals and activities require complex decision making and higher-level thinking skills.

- Complexity of task students can accomplish ***[taskacc]***
  Access to outside resources via the Internet has extended and advanced the level of tasks that students are able to accomplish. Within the multicultural fest

project, for example, students were able to gather information about Ireland through a range of diverse sources. In addition to traditional media, such as textbooks, their sources included Grolier's Multimedia Encyclopedia, databases at Trinity College in Ireland accessed via the Internet, and interviews with Irish college students over electronic mail. Working together in collaborative groups, the students created reports and displays based upon the information derived from these multiple data sources. The word-processor and graphics software were used to produce texts, tables, and illustrations. The complexity of both process and product was increased through the use of the computer.

- Learning on specific tasks ***[kidlearn]***
  K.T. believes that LOGO activities have provided students with a stronger understanding of mathematical concepts, as well as logical and procedural thinking. She attributes this to the fact that the software provides direct interaction with geometric principles and requires adherence to procedure in order to run. K.T. also feels that some children compose better when writing at the computer, while others regard the computer primarily as a publication tool. For those whose writing is improved in this context, K.T. thinks that the ability to bypass manual transcription and to work with a clear and legible text are two facilitative factors. The activity of gathering information on-line has supported the development of more sophisticated research skills on the part of many students. Communication and writing skills are supported by electronic mail activities, both within the context of projects (e.g., interviewing marine biologists or Irish college students) and through ongoing personal "pen pal" exchanges between the students and individuals in distant locations.

- Creativity ***[create]***
  Creativity is valued in K.T. and A.P.'s classroom and this carries over to the use of the computer in writing and in project-based activities. Although the two teachers did not explicitly address this issue during interviews, it was clear from our observations that students are encouraged to bring their own sense of artful expression to their work, both on and off the computer. Graphics software is popular with students and is used within projects to create banners and illustrations. During the multicultural fest activities, students made frequent trips to the lab to create graphics to use in their various displays.

Before- and after-school sessions provide uninterrupted blocks of time in which students can engage in creative play and production at the computers. One of K.T.'s students spent several after school sessions exploring a recently acquired animation program. She created a colorful animated feature complete with soundtrack, which she was eager to share with any available audience. In this and other observed sessions in the lab, students' approaches to writing, drawing, and collaborative interaction at the computers exhibited many of the characteristics associated with creativity—e.g., flexibility, experimentation, transformation, and pleasure.

- Greater attention to how a product will be understood by others ***[audience]***
  The computer's use as a writing tool has raised students' concern for aspects of production and publication to a new level. Students like the professional looking quality of their texts, and they devote extra time to issues such as layout and formatting. Printouts are easier to read and share with others than handwritten texts. For students who are reluctant to share their writing with others due to poor motor skills, K.T. observes that the use of the computer makes a marked difference in their willingness to have others read their texts. The writing process approach stresses audience awareness, revision for meaning and the sharing of writing, so is difficult to separate the computer's effects from the instructional environment in general. Electronic mail activities provide unique opportunities for developing writing skills with an eye towards meaningful communication with a nonpresent audience.

- Technology skills ***[hackskl]***
  The high level of access to and support within the computer lab has fostered the acquisition of sophisticated technology skills, especially for those students who regularly choose to use the computers to conduct project work and/or who engage in self-selected lab activities outside of regular school hours. Within the Mini-School, technology skills are acquired within the context of meaningful, often student-initiated, activities. In this sense, the lab functions as a "functional learning environment" (N.N., 1994) in which tasks are perceived as authentic and valid from the point of view of the students. Within such an environment,

students are motivated to invest the time and effort needed in order to reach a high level of technological independence and proficiency.

K.T. and A.P. state that most of their students are more proficient at computer use than they are, and that when they are in need of assistance, the students are often their best teachers. Both teachers note that students take a great deal of pride in their level of expertise, and it is the general perception that these skills will serve them well in the future. K.T. comments, "When they get to college, they will know how to do these things, which I think is just incredible."

Limitations of Technology

- Limited Access

  A.P. feels that lack of access limits the computer's use as a writing tool, especially in a classroom where students are expected and encouraged to write everyday. The fact that students do not have access to computers in their homes also poses limitations in this regard.

  A.P.: *If we had enough computers and could use them every day, they could use it in place of their notebooks, but then you have the issue of home. They don't have computers in their homes...and a lot of their composing and revision is done at home, so there's a whole other issue. It's impractical the way the technology is, because it seems to be just kind of hanging. It's neither one or the other; it's neither nothing and it's neither everything. And I think it's got to be one or the other. We're using notebooks which seem archaic and obsolete in a lot of ways, but they're with them all the time, they're with them on the subways or on a trip or whatever. They have the access that we don't have any other way. And I want the kids to be able to write all the time. That to me is* [the] *first priority is the writing of it, not the technology. The technology is only a tool and right now it's not a good enough tool.*

[DRAFT: PENDING INPUT FROM TEACHER.]

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	Computer Lab Activities
Teacher:	P.Q.
Site:	Maynard Computer Mini-School
Site Visit Dates:	May 23-27, 1994

1.0 Summary [*sum*]

The Computer Mini-School (CMS) is made up of eight classes (4th through 6th grade) operating as a school-within-a-school at the Maynard Elementary School in a large northeastern city. The Mini-School was formed to allow for smaller class size, a more coherent program, and extensive access to network and tool technology to support learning across the curriculum. Mini-School classes are scheduled into the computer lab for two periods each week. These sessions have focused on a range of technology-supported activities and applications (e.g., word processing, telecommunications, spreadsheets, databases, HyperCard) and are planned in collaboration with the classroom teacher. In addition, students are given flexible access to the lab during school hours, as well as before and after school, for individual and collaborative project work and for self-selected activities.

2.0 Classroom Context [*context*]

The computer lab is equipped with 25-30 computers, linked on a LAN to a Gateway 2000 file server providing access to a full range of tool applications (e.g., word processor, database, spreadsheet) and a wide array of instructional software. Each student has a folder on the file server containing his/her individual work. In addition, each student has his/her own e-mail account. The WAN features a high-speed data line (56KB) and a client-server model of access that enables students to connect with resources on the Internet as readily and as easily as they are able to access local applications. Up to 80 students can use the Internet link simultaneously; front-end user interfaces (Gopher, Mosaic) facilitate the location and utilization of available resources.

The computer lab is located on the same floor as all but one of the eight Mini-School classrooms. Most of the technology use within the Mini-School occurs in this lab setting. Although each classroom is equipped with one or two computers, these machines are rarely utilized, due to the fact that these are older models (mostly IIe's) and students have such ready access to the more sophisticated equipment within the lab. The lab is open from 8 a.m. to 6 p.m. daily. In addition to 16 scheduled classes each week (two 1-hour sessions per classroom), the lab is open to students during school hours between scheduled classes and through lunch, as well as before and after school. Students make heavy use of these flexible periods of access for writing, research, and other project-related work as well as for self-selected and recreational activities.

The lab is managed and operated by P.Q., one of the founders of the Mini-School and the computer coordinator. He brings to his position a strong background as an elementary school teacher (14 years at the 3rd- and 4th-grade level) and a wealth of self-taught knowledge and expertise (supplemented with college courses) regarding the instructional use of technology and networking. P.Q. teaches the scheduled computer classes, oversees all lab activities, and manages the school's network.

The Mini-School teachers range in terms of their levels of interest in and familiarity with technology. Although the Mini-School classrooms share an identity and a commitment in terms of the program's fundamental mission to provide a higher quality of education to students, most classrooms operate independently of one another and each teacher has implemented a curriculum that reflects his or her particular instructional approach. For the most part, technology instruction is left to the computer coordinator. Whenever possible, P.Q. attempts to coordinate lab class activities with the ongoing curriculum of the classroom. P.Q. takes the lead role in teaching the scheduled classes, with teachers assisting with instruction and overseeing any of the disciplinary issues that arise. All of the teachers value their students' use of technology and provide opportunities for them to make use of the lab for individual and collaborative work. However, few teachers have incorporated technology into their own instructional practice. Most of the teachers within the Mini-School stated that their students were far more proficient with the use of technology than they. A few teachers who have taken a stronger interest in integrating technology into their own instructional activities work with P.Q. informally, often after school, in order to acquire the necessary skills and experience.

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

S Interdisciplinary
S Project-based
S Collaborative Learning
S Mixed Age
S Extended Activity
S Part of Core Program
S Teacher as Coach

(S = Some classes)

Notes: Mini-School classes differ in terms of their instructional approaches. In some classrooms, the curriculum is organized around interdisciplinary and extended collaborative projects, with teachers acting primarily as facilitators and coaches. Other classrooms feature a more traditional approach, with the curriculum organized around teacher-directed lessons and individual seat work. Classes are single grade level and function as independent units with one exception. Due to an asbestos crisis and classroom shortage at the start of the 1993-94 school year, a 5th-grade teacher and a 6th-grade teacher combined their classrooms. The arrangement worked out so well that they decided to continue teaching as a team.

4.0 Description of Activity [*activity*]

Each Mini-School classroom is scheduled into the computer lab for two 1-hour periods weekly. These whole-class sessions are planned with the teacher, in conjunction with the ongoing curriculum of the individual classroom. P.Q. takes primary responsibility for instruction, with the teacher assisting and overseeing the management of the class. Classes often begin with a brief period of instruction, followed by individual or collaborative student work at the computers. For tasks that involve a series of new procedures (e.g., LOGO programming, building a HyperCard stack), students are given worksheets providing step-by-step instructions, with spaces for the instructor to "sign off" indicating that the student has completed each step correctly. During the session, the instructors circulate among the students, providing assistance as needed.

During our site visit, several whole-class sessions were observed. One group of 6th graders worked on a series of LOGO problems. Although each student worked at his or her own station, a great deal of collaboration occurred as students shared their ideas, solicited one another's assistance, and monitored each other's progress. The activity involved creating a series of stacked boxes that were to meet particular criteria using LOGO procedures. The children's classroom teacher commented in her interview that LOGO activities have helped her students develop a better understanding of mathematical concepts and of procedural, "logical" thinking. The weekly LOGO class is an integral part of the math curriculum within her classroom.

During another whole-class session, a different group of 6th graders created HyperCard stacks. Within their classroom, the students were learning Spanish and were also studying Mexico as part of the school's multicultural fest. The HyperCard activity involved linking Spanish labels to objects (e.g., linking the label "LA VENTANA" to a picture of a window). Students used the Mac software graphics tools to draw the objects (a room with a table, chair, door, and window) and create the labels in various sizes and fonts. When their stack was completed, a click on any of the objects was followed by the flash of the corresponding label on screen. This was the first time many of the students had used HyperCard, and a number had difficulty understanding how to link the appropriate objects and labels. As students worked, P.Q. and the classroom teacher went from station to station providing assistance.

A group of 5th graders spent one lab session writing reports on their Mini Orchestra experiences on the word processor. The Mini Orchestra Club was a city-funded project that enabled students to attend a series of concerts downtown. Students were asked to write about their favorite performances and to critically review various aspects of the program. Some students had prepared original drafts with pencils, which they transcribed and edited at the computer. Others composed directly at the computer. The classroom teacher stated during her interview that most students are able to compose more readily with the pencil, due to greater familiarity and access, as well as due to their general lack of keyboarding skills. The process approach to writing within the classroom emphasizes the use of pencil-written or hard copies for editing (for proofing, crossing out, making notes). Once this stage is completed, the computer facilitates the implementation of the revisions and the final publishing of the text. The teacher commented that for a small number of students, the computer was a preferred writing tool for all phases of the writing process. She felt that students needed to have a strong understanding about the purpose of revision before they could utilize the editing capabilities of the computer in a way that would improve upon the quality of their texts.

Several whole-class sessions focused on writing activities using e-mail. During two separate sessions, 5th graders and 6th graders wrote and sent e-mail messages to P.Q. on the subject of "If I Were in Charge of the Computer School." During another session, 4th graders directed their messages regarding "If I Were in Charge of the School Yard" to the school principal. These activities combined creative writing with familiarizing students with the use of e-mail. Students appeared to enjoy the topics, and the notion that they were writing for a specific audience seemed particularly motivating. As P.Q. assisted students with the procedures associated with sending e-mail, the classroom teachers focused on writing process issues (e.g., content, the use of formal conventions).

Excerpts from student e-mail messages:

> Dear [Mr. Q.]
> If I were in charge of the computer room I would say that people who want to come in the computer room would stay busy and always have something to do. I also think that people should always do something that they like to do and they feel happy about what they are doing.
>
> [Mr. Q.]
> If I were in charge of the computer room I will help people on the computers...learn how to write on the computers. If it was my job I would have 200 computers so they could have their own computers...
>
> ...If I were in charge of the computer school, I would make 100,999 copies of the computer school News Paper so everyone in the world could see all the work about 30 children has done...

In addition to the whole-class sessions, many students used the computer lab throughout the school day and before and after school hours for their individual and collaborative project work and for self-selected activities. Project work consisted primarily of writing with the word processor, creating graphics to incorporate in reports and other project-related products, and searching for information on-line. The week of our visit was the week of an all school "Multicultural Fest" and many of the computer activities that we observed were tied to this event, as students conducted research and prepared graphics, banners, information cards, and reports on their classrooms' featured countries.

A group of students in the 6th-grade class prepared their menu for the Mexican food that they planned to serve at their festival "restaurant," writing the text in both English and Spanish and designing a decorative cover page using word processing and graphics software at the computer. Another group of 6th-grade students created a welcoming festival banner featuring "KENYA" in bold print. The banner was designed with *Print Shop Delux* (graphics software) and printed out on the printer. A steady stream of students came into the lab throughout the week to search for information about their respective countries. Many students used the on-line almanacs and encyclopedias to gather facts and definitions regarding various aspects of their country's geography and culture (e.g., costumes, flags, regions, legends). A pair of 6th-grade girls used Gopher to search the Internet for information about Ireland and were able to access the library archives at Trinity College in Dublin. Another group of boys in the same class exchanged e-mail messages with Trinity College students, asking them various questions about their country's climate, their jobs, and favorite sports (see excerpt below). A 6th-grade student in another class searched an on-line CIA database for information about Brazil. Students used the scanner to copy pictures and graphics for inclusion in their reports and posters.

Excerpt from student e-mail message to college student at Trinity College:

> Hi my name is [Billy] and I am an elementary school student...I am writing to you because I wanted to ask you some questions about Ireland. My school is having a multi cultural fair and we picked Ireland. We want to learn more about the different professions in different countries the kinds of perfusions we would like to know like some of the sports and major jobs and some minor jobs...

As students worked on Multicultural Fest projects within their classrooms, they were given flexible access to the computer lab. Students came to the lab individually and in pairs and worked independently at the computers in a self-directed manner. When they were in need of assistance, they often sought the aid of a peer before requesting an adult's guidance. Many of the students were proficient in the basic tool uses of the computer, whereas Internet searches required more frequent assistance. One of the most impressive aspects of the use of technology at the Mini-School was the ease with which the lab was integrated with the ongoing activities of most of the classrooms. This observation stands in contrast to the more typical arrangement within many schools, in which computer labs function as isolated and separate units with limited access.

Self-selected computer activities in the lab before and after school varied. Popular activities included playing instructional and arcade-like games (*Math Blasters Outnumbered, Rescue Mission, Rabbit Reader, Time Treks, Carmen Sandiego*), creating graphics using *Rainbox* and *Kid Pix*, and exchanging e-mail with pen pals. A few students who were described as the most active computer users stay after school to work in the lab on an almost daily basis. In addition, former Mini-School students (now in local junior high and high schools) return to the computer lab to gain access to the technology. These active users and former students spent their time engaging in some of the more sophisticated computer activities, such as using Gopher and Mosaic to explore the Internet and creating HyperCard stacks. As new products and applications become available, P.Q. shares them with the after-school contingent, giving the students an opportunity to figure out various aspects of the software for themselves. For example, during our visit, several students participated in real-time video conferencing using a telecommunications system called C U See Me (see the team-teaching debriefing for description). The system is still under development and has not yet been integrated with instruction; however, children's initial explorations generated much enthusiasm and were suggestive of the kinds of activities that might be particularly of interest from an educational standpoint (e.g., being able to demonstrate as well as tell, sharing project work).

Other after-school lab activities (not observed) include a newspaper club and a Video News Club. The newspaper is written, edited, and published by a team of students on a monthly basis (six to seven issues a year). In addition to the hard copies that are printed and distributed, excerpts and articles are placed on-line and appear on the Maynard home page that is accessed through the Internet on World Wide Web.

The availability of the lab before and after school hours provides students with a safe haven, away from the problems that are encountered on city streets. For many students, the computer lab represents a motivating context in which their individual skills and interests are recognized and supported. The high level of voluntary participation outside of regular school hours indicates that this is a setting where students feel safe and are free to engage in activities that are enjoyable and meaningful to them. Throughout our site visit, students took great pride in what they were able to accomplish at the computer, and were eager to share their work and their technical knowledge and expertise with us.

5.0 Technologies Involved [*types*]:

Y Microcomputers [25-30 Macs in lab, Gateway 2000 file server]
Y Word processing [Microsoft Works/Claris Works; Page Maker]
Y ILS [CNS ILS Lab w/ 21 Macs is available to students; connected to LAN]
Y Spreadsheet [Microsoft Works/Claris Works[
Y Other LANs [Network is connected to the school's CNS ILS system and administrative network]
Y Hypermedia
Y WANs [high speed data line with client server model of access; up to 80 students can access the Internet simultaneously (Gopher, Mosaic)]
Y Animation [LOGO Writer, Kid Pix II]
Y CD-ROM [Available on network]
Y Simulation [e.g., MECC software such as Oregon Trail]
Y Interactive videodisc
Y Video cams and editing equipment [Video News Club; project documentation]
Other Interactive Video [real time conferencing through "C U See Me"]
Scanner

6.0 Technology Use

- Student Uses [***kiduse***]

Tutorial ***[tutor]***

Yes. Instructional games (e.g., Math Blaster) and tutorial programs (e.g., Humanities Software Key Words) are available for self-selected use. Students may also access the school's CNS ILS software, either in the ILS Lab (when it is not in use by the regular school) or on the machines in the Mini-School computer lab via the school's LAN. The Mini-School does not emphasize the use of the computer as a tutor, however. Teachers have used CNS very little.

Exploratory ***[explore]***

Yes. A range of exploratory software is available to students, including simulations (e.g., Oregon Trail) and other programs such as Grolier's Multimedia Encyclopedia. Students explore mathematical concepts and geometric principles through guided LOGO activities (whole-class sessions). Taken altogether, the information system available through both local and wide area networks represent an exploratory use of technology in the sense that students can browse through a vast array of resources in an exploratory fashion, with the aid of a seamless interface that enables ready access with the click of an icon.

Communication ***[commtn]***

Telecommunications is a primary use of computers within the Mini-School. Students have their own e-mail accounts, which they use extensively to communicate with personal pen pals and to gather information from a wide range of sources (e.g., on-line almanacs, experts in the field, university archives) for project-related work. In addition to exchanging text-based messages through regular e-mail, the lab has recently installed a real-time video-conferencing system ("C U See Me"). The system enables students to communicate via text, video, and sound with other C U See Me participants in locations across the country. The system is still under development at Cornell and has not been integrated with instructional purposes as yet, but has already generated a great deal of enthusiasm and interest from the students who have had an opportunity to use it.

Tool ***[tool]***

The Mini-School emphasizes the use of technology as a tool. Students use the word processor (Claris Works) for many of their writing assignments, and especially for the preparation of final drafts. They utilize graphics and desktop publishing programs (*Kid Pix*, *Page Maker*) to design covers for reports, to create banners, and for other project-related tasks. Whole-class activities and instruction within the lab have introduced students to the uses of databases and spreadsheets within the context of their curriculum. The 6th graders have used HyperCard as a tool for creating presentations.

- Teacher Uses **[*tchuse*]**

Communication

P.Q. uses e-mail extensively to communicate with outside resources, to gather information, and to inform the electronic community of Mini-School activities. A few of the teachers use e-mail to communicate with students and other teachers, as well as to link with outside resources. Such use is relatively rare, however.

Presentation

Not mentioned or observed.

Instructional Management

Not mentioned or observed.

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration
  Mini-School teachers differ in terms of their approaches to student collaboration. In classrooms where students engage in group project work, the computers are viewed as a context that facilitates the collaborative process.
- Independent exploration
  Yes. Students within the Mini-School are encouraged to take responsibility for their learning activities. Their use of the computer lab is generally viewed as an opportunity for developing both the skills and the confidence associated with independent exploration and discovery.
- Access to outside information resources
  Yes. This is a major component to the computer lab, which has been equipped with a level of Internet access that is rarely observed in school settings.
- Support for higher-level thinking
  P.Q. reports that support for higher level thinking was an "important motivation" for using technology. He attributes this focus, in part, to the influence of an outside researcher/collaborator who "pushed us" to think about this issue in relation to the Earth Lab project.

- Creativity
  Not mentioned.
- Technology skills
  Yes. Most teachers stated that the acquisition of technology skills was important to their students' future success in school

8.0 Realized Benefits of Technology [*kidout*]

- Motivation ***[motiv]***
  Yes. Throughout our site visit, students were eager to share their computer work with us. Teachers commented that students are highly motivated to use technology. Many students take pride in the fact that they are more proficient in the use of technology than many of the adults they know. The use of e-mail to make connections with peers in distant locations and to gather information directly from "authentic" sources (e.g., experts in the field, university archives) appears to make particular activities, such as writing for communication and conducting research, more meaningful and worthwhile from the perspective of the students. For some children, the computer is an especially motivating and enabling writing tool (whereas others prefer composing initially with the pencil and transcribing and editing their texts at the computer). Most teachers commented that their students take pride in the professional appearance of the products that they are able to create at the computer.

- Attendance, time on task, discipline ***[kidbehav]***
  During our lab observations, students were on task and discipline problems were rare. One of the Mini-School teachers commented that working at the computer helps students to focus and to calm down when they are having behavioral difficulties.

- Amount of collaboration and cooperative learning skills ***[cooplg]***
  Yes. Students were frequently observed to assist and collaborate with one another while working at computers, especially when engaged in activities that required a higher level of problem-solving or computer skill (LOGO programming, creating HyperCard stacks, conducting searches on the Internet). Classrooms differed in

terms of the level of collaboration that was encouraged, and this emphasis generally carried over into group activities in the computer lab.

- Ability to manage own learning ***[selfreg]***
  Yes. Outside of the structured classes, student use of the computer lab is primarily self-initiated and self-monitored. Students make self-selected choices regarding when to use technology as a tool for particular tasks and much of their activity in the lab was self-regulated. This was one of the most impressive features of the Mini-School program.

- Access to outside information resources ***[outinfo]***
  Yes. The network system installed within the Maynard computer lab enables a high level of access to outside resources via the Internet. Students make regular use of this resource, both for exchanging personal information with pen pals in distant locations and for gathering information and conducting research through access to on-line resources and through communication with experts within the field. During the Multicultural Fest, students gathered information about selected countries from a wide array of outside resources, ranging from library archives at Trinity College in Dublin, to multimedia encyclopedias, to a CIA database, as well as through e-mail interviews with individuals living in the countries being studied. One teacher commented that accessing information from a range of sources (representing different perspectives and often different modalities) provides students with a stronger grasp of the information being gathered. The ability to directly link with individuals and other outside sources enhances the authenticity of the research task, as students connect the information they acquire with real places and people.

- Support for higher-level thinking ***[higher]***
  Yes. Many of the activities observed in the computer lab were complex tasks (composition, programming, research) that involve higher-level thinking skills and problem solving.

- Learning on specific tasks ***[kidlearn]***
  Yes. Specific information-gathering skills and strategies are acquired in the process of conducting on-line research. Beyond the technology-related procedures associated with using e-mail and the Internet, students are learning a range of research skills, including: how to search for information by key words, how to focus

a search on particular topics that are relevant to the question, how to conduct interviews in a text-based medium (e.g., what background information to provide an informant, what questions to ask), how to select the most appropriate information for use within a report. Students were at various stages in their learning of these skills, but it was clear from our observations that these were important underlying issues throughout their learning process.

- Creativity ***[create]***

  Yes. Students were observed to use graphics software and music programs as a means for artistic and creative self-expression. One 4th-grade student spent her lunch period "recording" songs that she had made up and playing them back at the computer. A graphics program that had recently been installed (*Rainbox*) on the file server was in high use throughout the week. A 6th-grade student who was one of the most active after-school computer users created a colorful "animated" sequence using *Kid Pix II*. She spent several sessions designing the graphics and the sound track, playing the finished product back on various occasions to her own amusement and to the delight of others.

- Greater attention to how a product will be understood by others ***[audience]***

  Not mentioned in interviews, however, this appears to be an important aspect of learning to communicate with nonpresent audiences via e-mail.

- Technology skills ***[hackskl]***

  Yes. Students within the Mini-School receive regular instruction on technology use and have a high level of individual access to a wide range of tools and applications. In addition to directed activities, they are given the opportunity to explore according to their own interests and at their own pace. As a result, many of the students are proficient with the basic tool applications. Students who have invested time in self-selected activities have developed more sophisticated skills corresponding to their areas of interest (e.g., using the Internet, creating graphics, building HyperCard stacks).

NATHANIEL ELEMENTARY SCHOOL DEBRIEFING

Site:	Nathaniel Elementary School
Point of Contact:	J.K. Technology Coordinator P.H. District Teacher on Special Assignment–Technology & Curriculum

1.0 Summary [*sum*]

Nathaniel Elementary is a large year-round K-6 school serving a low-SES student population of diverse ethnicities. The school has a long-standing commitment to educational reform, with a strong emphasis on cooperative learning and programs addressing the social and affective needs of students. Nathaniel is one of 14 original Demonstration Schools, funded through district voluntary desegregation funds to implement schoolwide change. The implementation and integration of technology throughout the curriculum has been a key component of Nathaniel's reform efforts. Within the district, Nathaniel is regarded as a model site with respect to its socially oriented programs (such as Conflict Management and TRIBES) and its use of technology. Classrooms within the school serve as development sites for two technology oriented projects: CSILE (Computer Supported Intentional Learning Environments), a collaborative knowledge-building program in which students construct and share information and theories through a communal database; and Project Galaxy, a video-based program in which students engage in group problem solving (in response to issues posed in a video series) and share their ideas with other students via satellite-supported facsimile machines. In addition to these two special projects, technology is integrated in other classrooms through many areas of the curriculum with the support of a full-time technology coordinator. A take-home computer program and computer-based adult literacy class provide parents of Nathaniel students with opportunities for technology access and training.

2.0 Context and Reform Overview

2.1 Educational Context [*context*]

Setting. Nathaniel is located within a couple of miles of downtown, in a low-income neighborhood of a western city. The area has an influx of immigrants each year, causing the schools LEP/NEP population to increase annually. The immediate area is regarded as high risk due to high crime rate, drugs, and gangs. Classrooms are housed in multiple buildings. Nathaniel's main building has nine regular classrooms and four half-sized classrooms for special education and resource labs. It is a traditional structure built in 1939, brightened by the colorful display of student art work throughout the halls. The school's computer lab is located in the main building. There are 18 portables located in the back of the main building, scattered across a concrete yard. In 1990, Nathaniel was joined to a center for children with special needs, allowing for integration with students in regular education classes and providing Nathaniel with additional classroom space. The center consists of two larger buildings (located adjacent to the portable units) which house a total of 20 classrooms.

Grade levels. Nathaniel serves 1,400 students in grades K-6. This enrollment includes 70 SDC (Special Day Class) students. Grades are organized into both single and mixed grade units.

2.2 Demographic Information [*demo*]

Applicable unit: [✓ School] Class Project District Other

Number of certified teachers (FTE) as of 9/93: 44 teachers (38 FTE + 6 half time); 7 special day class teachers; 1 resource specialist; 9 aides to handicapped; 2 itinerant psychologists; 1 adaptive physical education teacher. In 1993 six teachers worked on a half-time basis, team teaching in pairs within three classrooms.

Enrollment as of 9/93: 1,400 (Including 70 SDC or special day class students). This number represents an increase of 150 over the 1992-93 previous school year.

Number or percent free or reduced lunch: Principal reports 85%; 1991-92 Executive Summary reports 73%. The principal reports that the number fluctuates due to difficulties in getting federal forms returned. An estimated 42% of the students qualify for AFDC.

Number or percent LEP or NEP: 800 or 59% in 1991-92. (This figure increases every year). Languages spoken: Spanish (65% of non-English language at the school), Cambodian, Mien, Lao, Vietnamese, Tagalog.

Number or percent special education: 68-70 special education students; 35 students are in a special education pull out program.

Ethnic Composition (Number or percent in each category)

19%	African American
57 %	Hispanic
5%	Caucasian, Non-Hispanic (Includes Native American)
23%	Asian/Pacific Islander
%	Other

Estimated percent students w/ computers in home: 1%.

The school has a take-home computer program, providing families with Mac Classics on a four-week loan. Participation is self selected; parents are required to attend a six-hour training session covering the basics (how to turn the computer on and off, how to load programs) before taking the computers home. The technology coordinator notes that students, rather than parents, tend to make the greatest use of the computers within the take-home program.

2.3 Education Indicators [*stats*]

In the Spring of 1992, the second graders scored (CTBS) at the 8th percentile in reading; 7th percentile in language; and 14th percentile in math. The sixth graders scored at the 19th percentile in reading; 24th percentile in language; 30th percentile in math. Attendance for 1991-21 was 93%. Mobility index (ratio of student transfers/ withdrawals) was 30. All sixth graders were promoted to junior high. 2.5% of the students were retained. The incidence of student suspensions was 3%. The Assistant Superintendent of Curriculum and Instruction reports that Nathaniel's test scores are "on par" with the rest of the district. She adds that Nathaniel has a much smaller percentage of students who are retained or suspended, which she attributes to the school's focus on conflict management and other programs addressing the social/affective needs of the students.

2.4 Reform History [*reform*].

- Nature and when started [*history*]

  Nathaniel has had a long-standing commitment to educational reform. In 1987 the school began implementing programs that addressed the social and affective needs of students, such as Conflict Management and TRIBES. Nathaniel pioneered these programs within the district and established a reputation as an educational community that possessed the dedication, expertise, and leadership that are critical to successful program implementation. As opportunities for technology implementation arose within the district in the early 1990s, the school was among the first to apply for and receive special project grants and funds. In 1991, the school was selected as a CSILE development site. In the Spring of 1992, Nathaniel became one of 14 Demonstration Schools funded by the district through voluntary desegregation funds to implement technology-supported schoolwide change.

One of Nathaniel's veteran teachers, G.W. (a CSILE classroom teacher and a Conflict Resolution mentor teacher for the district), states that a lot of the restructuring at the school level came about as a result of the interaction between the school's principal and the teaching staff. The school community was searching for ways to solve the problems they were facing: how to make education more relevant to the population that they were serving; how to prepare students for the 21st century; how to address the "horrendous drop out rates of children of color." With all of this problem solving, a number of new programs were identified and adapted for implementation in the school. A conflict management program was introduced, in which students are trained to act as mediators in the resolution of conflict between their peers. Another socially oriented program developed by the Center for Human Development (TRIBES) was implemented. The principal describes the TRIBES program as "a social group process" in which students are taught a series of norms (e.g., attentive listening, confidentiality, appreciation and respect for others, "no put downs") for working together cooperatively in groups. Together these programs are credited with reducing discipline problems within the school, facilitating cooperative learning skills schoolwide, and laying the groundwork for other new programs.

At the district level, a Demonstration School project was funded in 1992 with voluntary desegregation funds. The project was the springboard and core component of the Superintendent's "5 Year Education Plan." The intention was to provide intensive resources to a fixed number of schools, which would then serve as demonstration sites for the rest of the district. Underlying the project was a commitment to schoolwide change and consensual decision making. Nathaniel was among the original cohort of 14 schools (7 elementary and 7 secondary) funded within the program. The program components included: adoption and implementation of a schoolwide improvement model (in alignment with essential conditions outlined by the district); 10 to 15 days of additional staff development; extended instruction for students at risk (20 days of additional instruction); and integration of technology into the curriculum. Demonstration Schools continue to be funded each year for ongoing staff development and program implementation. Ten additional "Focus Two" schools were funded during the 1993-94 school year and plans are currently underway to fund "Focus Three" schools, all at the middle school level, in 1994-95.

The planning and implementation process for this district-wide restructuring effort has evolved each year, based upon ongoing reflection and corresponding adaptations. For example, the district has shifted to an increasingly flexible process in allowing schools to determine their educational approaches and uses of technology. When Nathaniel was funded in 1992, participating schools were asked to chose from two schoolwide improvement models: the Bruce Joyce/Beverly Showers Models of Teaching or the Comer Process. For Nathaniel and many other schools, these choices were limited. Nathaniel in particular found that the Models of Teaching training did not take into account the level of sophistication and expertise that was already in place at the school. Fortunately, Joyce and Showers adapted their consultation and training accordingly as they became familiar with the school community. In the second year of the project, Focus Two schools were given more flexibility in determining change models (Accelerated Schools, Coalition of Essential Schools, and High Scope's Developmental Education were added to the list and schools were not limited to these choices). The technology implementation component has also been adapted to allow for more time for developing schoolwide plans prior to decision making regarding equipment purchases.

With funds from the Demonstration School project, Nathaniel has implemented a range of programs. A large portion of the first year funds was spent on technology (see Tech Applications), including additional computers for classrooms, the lab, and a take-home computer program.

- Reform Features **[*feature*]** (circle all that apply)

  Nongraded groupings
  Y Extended periods
  Y Schoolwide themes
  Y Mixed Age
  Y Teacher professionalization
  Y Authentic assessment
  Y Use of outside resources

- Key Individuals **[*key*]**

  A.G., the school's principal since 1986, is regarded as a leader of educational reform within the school and across the district. She has actively sought outside funds to support reform efforts within her school, and has encouraged her teachers to participate in a range of innovative programs. She facilitates bottom up leadership, involving teachers in decision making in all areas. A.G. was retiring (going into part-time private consultation) during the month of our site visit (November 1993).

  The district superintendent, **P. M.**, is described as supportive of school reform efforts throughout the district. He initiated the Demonstration School project and the Five Year Education Plan that serves as an overall vehicle for the district's restructuring efforts. The former Assistant Superintendent of Curriculum and Instruction was instrumental in securing the school's original technology grant and made the initial connections with CSILE. The current Assistant Superintendent of Curriculum and Instruction, has played a key role in the design and implementation of the Demonstration School project. **P.H.** is the Teacher on Special Assignment for Technology and Curriculum within the Demonstration School project (a district level position). His role is to assist schools in developing and implementing their reform/technology plans in alignment with the district curriculum.

Nathaniel teachers, as a group, are experienced and well educated (average of 13 years experience; 98% have at least 30 units beyond a B.A. and 35 % have Masters). Many teachers have taken an active role in various aspects of the reform effort at the school level (proposal writing; professional development; exploring and adapting innovative programs) and district level (serving on committees; sharing information with others).

- Funding sources for reform **[*funds*]**

In addition to state and federal funds, Nathaniel has received support from private business, universities, and foundations. State and federal funds allocated for categorical aid totaled about $700K in 1992-93. The sources included Economic Aid/Compensatory Education, Economic Aid/Limited English Proficiency and School Improvement Program. SB65 funds ($45K annually, targeted to assist at risk students) were used to hire a consultant who has supported the implementation of TRIBES, and peer and cross-age tutoring, as well as working with teachers individually to aid them in identifying and assisting students at risk. An additional state grants program (SB620) has enabled Nathaniel to begin implementing comprehensive site-based family services. Substantial support for reform and technology efforts came through the district's voluntary desegregation funds (Demonstration Schools Focus One). The Demonstration School program provided $400 per student additional funding in 1992-93 and $300 additional per student in 1993-94. The allotment will continue at this level ($300 per student) in 1994-95. The recommendation from the district in the initial funding year was that 25% of these funds go to technology (of that 50% hardware; 25% software; 25% staff development). The district has since given schools greater leeway in determining the allocation of funds. When the district was approached by the CSILE and the Galaxy projects, school proposals were solicited. In each of these cases, Nathaniel applied and was selected by the district for participation based on the school's strong commitment to innovative educational programs and professional development. The research component of CSILE was funded by the McDonnell Foundation; the equipment (15 Mac LCs) for use within the project was supplied by Apple. The Galaxy project was funded in part by

Hughes Aircraft Company (includes teacher training, curriculum kits, and equipment, as well as a research component).

- District involvement/support **[*localref*]**
  The district has taken an active role in initiating and supporting school reform at many levels. District administration and the School Board are described by members of the school community as actively supporting school restructuring and reform. The district's voluntary desegregation funds have been used to fund an ambitious district-wide restructuring effort, the Demonstration Schools project. Each year a new cohort of schools is inducted into the program (14 Focus One schools in 1992-93; 10 Focus Two schools in 1993-94; Focus Three will involve an undetermined number of middle schools in 1994-95). The project provides substantial funds to support educational reform at the school level. Participating schools engage in self-reflection and assessment, choose an educational model, and plan and implement schoolwide changes based upon identified needs and a chosen model. A significant portion of the initial funding is used for technology implementation and staff development. Nathaniel is a Focus One school, one of the first fourteen schools to participate in the Demonstration Schools project. It is regarded as one of several model schools within the district. The district has been successful at attracting grants and projects (e.g., CSILE, Galaxy), which have then been awarded to Nathaniel based upon the school's track record for successful implementation of innovative programs.

  Schools participating in the Demonstration School project receive district technical assistance through P.H., in the areas of technology planning, training, and ongoing alignment with curriculum. P.H. comments that Nathaniel has been able to handle most of its support internally, whereas other schools depend more heavily on district involvement. He attributes Nathaniel's greater self sufficiency to several factors, including: strong leadership, a high degree of teacher professionalism, and the presence of an on-site technology coordinator (J.K.).

- State/federal involvement/support **[*stateref*]**

State and federal funds allocated for categorical aid totaled $700K in 1992-93. The sources included Economic Aid/Compensatory Education, Economic Aid/Limited English Proficiency and School Improvement Program. SB65 funds ($45K annually, targeted to assist at risk students) were used to hire a consultant who has supported the implementation of TRIBES, peer and cross-age tutoring, as well as working with teachers individually to aid them in identifying and assisting at risk students. An additional state grants program (SB620) has enabled Nathaniel to begin implementing comprehensive site-based family services.

The district is currently addressing the issue of requesting waivers from the state in order to implement various restructuring plans. For example, middle schools participating in Focus Three (the 1994-95 cohort of demo schools) may need waivers from state credentialing requirements. The Assistant Superintendent for Curriculum and Instruction reports that the state has encouraged the district to seek the waivers, but the process is in the early stages and the outcome is unknown.

The core curriculum and student outcomes developed at the district level were designed to correspond to the state framework.

- Role of tech in reform efforts **[*techref*]**

  Part of initial reform concept
  Emerging part of reform efforts
X Parallel effort

Education reform and technology implementation have evolved hand in hand at Nathaniel. There are many different special programs operating simultaneously within the school, some of which have included technology as an initial focus, others in which technology emerged as a component late in the process. Within the Demonstration School project, Focus One schools were required to include technology integration in their plans and in their use of first-year funds (a recommended 25% of the funds were to be used for technology). Special projects, such as CSILE and Galaxy, were brought in largely because they fit in well with the school's ongoing reform efforts. For example, CSILE built upon the group investigation approaches that were already being used within some classrooms. One of the teachers comments that CSILE came about after the restructuring process was underway; "technology fits into the larger scheme of restructuring, which has been a gradual process."

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*]

Members of the Nathaniel school community (administrators and teachers) who we interviewed echo one another in their perceptions that technology expertise is critical to the future success of students as citizens and workers in the 21st century. Technology is further viewed as a tool that will motivate students, increase their self-esteem, and facilitate their learning in a wide range of areas (writing, problem solving, math skills). The notion of equity was also raised by several teachers who feel that it is especially important that schools serving lower SES students provide them with the technology tools that other, more affluent educational communities take for granted.

One of the 5th/6th grade CSILE teachers, stated that her goal for technology integration is that *"it mirrors the real world and the way that people in the real world use technology to do their work. That it is about communication, pursuing answers that you personally have an interest in. It's developing the computer as a tool to access information and to access knowledge around different concepts. The technology keeps changing and I don't know what they will be able to do. I just know that I want kids to feel they can use these technology tools to further their thinking, to understand the world, and to communicate their understanding in a community. That's the goal of technology to me."*

3.2 When & How Application Started [*how*]

Nathaniel has had a long-standing commitment to educational reform and professional development. Within the school community, cooperative learning skills and conflict management were strong initial areas in which key issues were addressed and new programs (e.g., TRIBES) were implemented. The introduction and integration of technology was largely initiated by the district, through funding opportunities that arose at this level and were applied for and received by Nathaniel. The principal believes that "a lot of opportunities came our way because they [the district] knew we'd do something with it." Nathaniel was eager to incorporate technology as a vehicle for furthering their educational reform efforts.

Technology use by students began in 1983, when the school installed an Apple IIe lab (18 computers) funded with state and federal funds (AB 803). In 1988, J.K. was hired as the school's computer lab teacher. Students came to the lab once a week during their classroom teachers' required 50 minute prep periods. Lab sessions focused primarily on word processing and instructional games. J.K. became increasingly frustrated with the arrangement because it did not allow for enough computer access to do activities that built upon and were integrated with the curriculum in meaningful ways. She attempted to introduce LOGO programming and found that children would forget the commands from one week to the next. At the end of the school year, the decision was made (by teacher vote) to separate the computer lab position from the constraints of the prep period. This involved shifting the funding of J.K.'s salary from district "prep teacher" funds to the school's own state and federal funds. The shift allowed for greater flexibility in how the lab was run. Rather than meeting with students for weekly 50 minute periods, J.K. was able to schedule 6 week courses that met three times per week (rotating between classes). The mini courses focused on a range of applications: keyboarding, word processing, instructional games, LOGO, and curriculum related projects such as building databases in content areas. Because lab use was separated from prep time, teachers were able to stay in the lab with their students, providing additional instructional support, and learning about technology in the process.

In 1990, Nathaniel was selected by the district as one of three schools to receive 45 Mac LCs for instructional use (J.K. comments, "It was like one day we heard about it and the next day they arrived!"). Fifteen teachers were selected by the principal and J.K. on the basis of their interest in incorporating technology into their classrooms. J.K. commented that the computers were initially installed with very little software support. The LCs arrived with a single application (Microsoft Works), which was used primarily by the teachers for the preparation of instructional materials. The school purchased site licenses for student oriented applications that would have broad uses and appeal, e.g., *Kid Pics* and *The Writing Center*. The district provided a site license and the school installed Apple IIe cards so that Apple software that had been purchased for lab use would run on the new machines. With three computers in their classrooms and the available applications, the fifteen teachers began using the computers with their students, primarily for word processing, drawing, and math.

The CSILE (Computer Supported Intentional Learning Environments) implementation was initiated by the former Assistant Superintendent of Curriculum and Instruction, who had learned that the developers of CSILE (Scardamalia and Bereiter) were looking for additional development sites with support from Apple Computer Corporation. He made the connection with the researchers and sent an article to all of the principals in the district, soliciting requests for participation. Several schools expressed interest in the project and Nathaniel was selected (one of four across the country). Within Nathaniel, teachers who were interested in CSILE were asked by the principal to write proposals describing how the project would enhance their programs. Four classrooms were selected by the principal and technology coordinator. Program implementation began in 1991 in three 5/6 classrooms (a 3/4 classroom was added the following year). Apple provided equipment (15 Mac LCs) and technical support. The school was provided with a modem and an AppleLink line that enabled teachers to communicate problems and concerns to the CSILE headquarters. The modem was located in the computer lab, rather than in CSILE classrooms, and was reportedly used only sporadically by the teachers.

Each CSILE classroom was equipped with a total of nine Macs (a combination of previously owned and those donated by Apple). The participating teachers were sent to a three-day training in St. Louis the first year (sponsored by Apple), with additional training provided each subsequent year. The project was riddled with system failures through the first two years. Frequent software updates and lack of ongoing technical support also made it difficult for teachers to utilize CSILE. In its third year of operation (1993-94), a combination of increased familiarity, stronger technical and curricular support (provided by CSILE project graduate students as well as the technology coordinator), in addition to improved software design has enabled better integration of CSILE throughout the curriculum.

Participating teachers comment that the CSILE program was viewed as a means to enhance goals that were already in place at Nathaniel: e.g., critical thinking, "getting away from the teacher being the source of knowledge," and cooperative learning. At the heart of the CSILE project is the use of technology to support collaborative problem solving, group investigation, and knowledge building. CSILE software consists of a communal database, with text and graphics capabilities, which students in the participating classrooms access through a local area network. In each of the CSILE classrooms, students spend at least one half hour per day entering new information, theories, and opinions to the database. They comment and critique one another's work on-line; locate information via key word searches; and construct links between related entries. Within Nathaniel, students have utilized CSILE in a variety of subject areas. They have constructed an ongoing on-line literature circle, sharing information within and across classrooms about books they have read. They have engaged in math problem solving, posting their solution strategies in graphics and text. Two of the 5/6 grade classrooms have incorporated CSILE into an interdisciplinary project in which students invent their own culture, then piece together another through clues gathered on an archeological dig (based on the "Dig" curriculum designed by Interact). Students in each of the classes built large databases describing and illustrating the components of the culture they have invented (language, food, art religion).

In 1992, Nathaniel became one of 14 Demonstration Schools funded by the district through voluntary desegregation funds to implement schoolwide change. The district suggested that half of the funds provided in the first year be used to support the integration of technology (hardware, software, teacher training). Nathaniel purchased 78 Classics, 45 Mac LCII's, video equipment, CD ROM, laser disc players, and five projection systems (for use with computers) with the first-year funds. Thirty of the Classics were targeted for use in a take-home computer program for families of students. Parents sign up on a self-selected basis, attend a three-part training session, and are given the computers on loan for 30 days. The remaining Classics are used in the portable classrooms and ten are reserved for teachers to check out for home use. The MAC LCII's were purchased in order to equip an additional five classrooms with a total of three computers in each, and to switch the school's computer lab from Apple to Mac. Inservice days funded through the project have been used for technology training, as well as for other areas of curriculum and program development (e.g., portfolio assessment; cooperative learning). Second and third year funding within the project will continue to support ongoing technology implementation.

The Galaxy Project is funded in part by Hughes Aircraft Company. In response to President Bush's AMERICA 2000 program, the company set up the Galaxy Institute for Education to develop and demonstrate model innovative educational programs. The Galaxy Project is a technology-supported video-based curriculum (with modules developed in language arts and science) designed for K-5 students. Students view weekly video segments (either in Spanish and English or close caption) as a basis for science or language arts projects. The video segments present issues and problems for students to solve. Between video segments, the students work in collaborative groups on related projects. They share their responses and research findings with other participating classrooms through facsimile machines linked to the Galaxy Institute via satellite. The Institute publishes a newsletter highlighting students' responses and includes selected entries in video segments. Each school is paired with partner schools for ongoing videotape and faxed message exchanges. (Nathaniel has partner schools in Florida, Massachusetts, and New York.)

The Galaxy Institute for Education supplies demonstration classrooms with all the necessary equipment: facsimile machines, one Macintosh computer and printer, video equipment, a satellite dish, teacher's guides. The science component is supplemented with hands-on activity kits that relate to the themes in the videos. The program is designed to complement widely used science curricula (FOSS and GEMS).

In 1990, the district began soliciting proposals for participation in a three-year Galaxy Classroom demonstration project. Nathaniel and Longfellow, another elementary school within the district, are among 40 schools across the country and Mexico participating in the project (all serving low-SES populations). The first year of the project (1991-92) consisted of laying ground work and correspondence between the Galaxy Institute and the school. A committee within the school selected teachers for participation based upon their proposals. Teachers were drawn to the project for a variety of reasons, including the opportunity to enhance cooperative learning skills, to "prepare students for the 21st century," and to link with other classrooms across the country. Beginning in 1992, participating teachers were provided with week-long training sessions focusing on each curriculum installment (planning in 1992; 3-5 language arts in January 1993; 3-5 science in Summer 1993; K-2 science in January 1994) during which they were introduced to the Galaxy approach and went through the hands-on activities together. Teachers report that the video segments and the related hands-on activities have been the strong points of the program. The facsimile machines were down an estimated 50% of the time, so sharing of information in this format was limited. Students in several classrooms participated in a video exchange with their partner school in Orlando, Florida. The principal and Galaxy project coordinator feel that the program has provided a training model for activity-based, cooperative learning. The school is currently making plans to purchase the program for the six participating classrooms, so that teachers may continue to use the curriculum beyond the demonstration phase.

In her six years at Nathaniel, the technology coordinator (J.K.) has played a key role in supporting the integration of technology at Nathaniel. She describes her role as having shifted from a computer lab teacher to a technology and curriculum resource specialist. In addition to assisting with special technology projects, such as CSILE and Project Galaxy, J.K. works closely with teachers to plan technology-supported activities that are integrated with the ongoing curriculum. Word processing is introduced early on, beginning in the first grade. Keyboarding is generally introduced in the 4th grade. (J.K. found that younger children lacked the necessary physical coordination.) Instructional games supplement and reinforce math concepts and skills. Exploratory simulations, such as *Odell Lake*, *Carmen Sandiego*, and *Oregon Trail*, are used in conjunction with science and social studies. Students build group databases within specific content areas (dinosaurs, book reports). During our visitation, a group of students in the lab were exploring ocean life (habitat, food chains) using a program called "*A Field Trip to the Sea*." The activity corresponded to their study of the rocky seashores. J.K.'s role is critical to the planning and implementation of these kinds of activities.

3.3 Technologies Used [types]

Y	Microcomputers [176 computers]
Y	Word processing
N	Spreadsheet
Y	Hypermedia
N	Animation
Y	Simulation
N	ILS
Y	Other LANs
Y	WANs
Y	CD-ROM [24]
Y	Interactive videodisc
Y	Videocams and editing equipment [3 cameras]
Y	Other: Satellite, television, facsimile machines (six total fax, each connected to satellite system)
	Telephones in classrooms
	Televisions and VCRs [4 VCRs]

3.4 Target Grades & Curricula [*levels, curric*]

There is a total of 176 computers in the school. There is a school Mac lab (28 Mac LCII's) that is used by all grade levels (for classes in keyboarding, word processing, and other targeted areas integrated with the curriculum of individual classrooms). There are at least three computers in most of the primary classrooms throughout the school. These are used primarily for word processing, drawing, and instructional software. Word processing is introduced at the 1st and 2nd grade levels. Keyboarding is generally taught in the 4th grade. J.K. explains that there is a lot of variation in computer use at the 4th through 6th grade levels. Most of the kindergarten classrooms have Apples IIe's. Portable classrooms are equipped with Classics (easy to move); and all other classrooms are equipped with LC's. CSILE has been implemented in four classrooms (three 5/6 and one 3/4 with 9 computers each) and is used for group knowledge building activities in language arts, math, and social studies. Galaxy was initially implemented in four classrooms (one 2/3 and two 4/5); units have focused on language arts and science. A kindergarten and a first grade classroom were added in 1994 with the introduction of a primary science unit.

3.5 Key School Players *[infield]*

J.K. is Nathaniel's full time technology coordinator. She runs the school's computer lab and supports the operation of the school's technology on a number of levels: participating in teacher planning sessions to assist the integration of technology into the curriculum, troubleshooting technical problems as they arise (e.g., getting the CSILE system up and running), providing assistance with software choices, training teachers and students in the use of particular technologies.

Two graduate research assistants have provided ongoing technical and curricular support in CSILE classrooms through the Fall, Spring, and Summer semesters of the 1993-94 school year.

Nathaniel's Galaxy Project Coordinator acts as liaison between the teachers participating in the Galaxy project and the program developers. G.W. and S.E. teachers team teach a 5th grade CSILE classroom. G.W. is also a TRIBES trainer for the school and district.

3.6 Outside Players in Technology Application *[outfield]*

- District involvement *[distr]*

The district has supported technology implementation at Nathaniel in a number of ways. Through the district, Nathaniel was selected for participation in technology applications funded through outside sources (CSILE and Project Galaxy). The Demonstration School project, funded through district voluntary desegregation funds, has provided major support for technology implementation, both in terms of equipment and staff development. The district provision of a MECC site license provided the school with needed software applications. The district has also provided needed security systems for the school's equipment.

Two district-level positions funded out of Chapter One assist with software copying and equipment repair. Schools participating in the Demonstration School project receive technical assistance from the district-supported teacher on special assignment for technology and curriculum (P.H.), in the areas of technology planning, training, and alignment with curriculum. In addition to meeting on a monthly basis with school technology leaders, P.H. is available for ongoing technical assistance and support. P.H. comments that, whereas many other schools depend heavily on the district for support, Nathaniel is able to handle many of its needs in this area internally, due to the fact that they have had a head start in technology use and have a full time on-site technology coordinator (J.K.).

- State involvement ***[state]***
  The district technology plan was crafted to coincide with the state's master plan for educational technology.

- Business involvement ***[bus]***
  Apple Computer provided hardware and technical support for the CSILE project (15 Mac LCs). The Galaxy Educational Institute (funded in part by Hughes Aircraft Company) funds the Galaxy Pilot Project.

- Foundation involvement ***[foundtn]***
  The research component of the CSILE project is funded by the McDonnell Foundation.

- Parent involvement ***[parent]***
  Parent involvement in technology implementation is generally described as low. Parents sit on technology committees, but often have little to say about this aspect of the program. The technology coordinator and principal have noted that this is expected to change as parents learn more about the uses of technology in the classrooms and through the take-home computer program.

- Other outside influences, including research
  Marlene Scardamalia is conducting research on CSILE's use within the classroom. Two of her graduate students have provided technical and curricular support through the Fall, Spring, and Summer semesters of the 1993-94 school year.

4.0 Overview of Tech Uses

4.1 Student Uses [*kiduse*].

- Tutorial

  Instructional software, primarily in math, is used within many classrooms and in the school computer lab. The technology coordinator comments that the school in general does not promote a drill-and-practice approach to learning. However, the software provides students with the opportunity to practice and build on their skills with individualized feedback.

  J.K.: *The math programs give them direct and immediate feedback, which is important. We do not spend a lot of time at the school doing drill and practice. We try to work with underlying principles in math. The games are drill and practice and if they don't get it right, there is help...a better visualization (say if it's three times five and they get it wrong, then they see three groups of five circled and they can actually see what three times five means and they can count the dots)...Otherwise teachers would have to do that...*

- Exploratory

  Simulation software is used within science and social studies (*Odell Lake*, *Oregon Trail*, *Carmen Sandiego*). Students studying rain forests and the ocean explore these environments using open-ended software that merges rich graphics with written information (*A Field Trip to the Ocean/the Rainforest, Cross Country USA*).

- Communication

  CSILE classroom computers are linked to one another, enabling students to build collaborative databases, sharing information and discussing their theories and opinions with their classmates and with students in other Nathaniel classrooms. A key component of CSILE focuses on teaching students how to engage in constructive commenting through written notes and messages (linked to student entries within the CSILE database). The school is in the process of installing modems and software in CSILE classrooms to enable students to link with CSILE sites across the country.

Within the Galaxy Project, students use facsimile machines to send messages to students in distant locations. The full potential of this telecommunications project was not realized because of frequent system failures. However, students were intermittently able to exchange messages with pen pals in Washington Shores, Florida (as well as to additional partner schools in Massachusetts and New York) and to send their proposed solutions (to problems posed in the video series) to the central Galaxy Institute. The possibility of having their responses and research findings shared with other classrooms in future video segments or magazine issues was particularly motivating to students.

- Tool

The primary use of the computer at Nathaniel is as a tool for word processing. Word processing is introduced early on, in the first and second grades. Database applications are also used, both within CSILE (using the MacCSILE software) and within regular classrooms. Video cameras are used by teachers and students as tools for recording and presenting student performances and projects. Laser disks and CD ROM are used as tools to access and present information.

4.2 Teacher Uses [*tchuse*].

- Communication

CSILE classrooms are networked to one another, however, the primary communication is between students. The school's computer lab was equipped with a modem and AppleLink to allow participating teachers to communicate with CSILE headquarters and with other participating teachers. This resource was used sporadically, most often to communicate to technical support staff at CSILE headquarters when technical problems arose. Plans are currently underway to equip each CSILE classroom with Quick Mail access that will enable teachers to share their progress and problems with teachers in other sites (beginning the 1994-95 school year).

The Galaxy system was set up to allow participating teachers from across the country to communicate with others via the facsimile machines, but this resource has rarely been utilized due to ongoing equipment difficulties. The program developers are exploring the future use of e-mail for the purpose of communication across classrooms.

- Presentation
  Teachers use laser discs for presentation purposes. The school is in the process of acquiring a series of FOSS discs for use in conjunction with the science curriculum. Teacher computer stations in CSILE classrooms are equipped with projection systems. This equipment was purchased with Demonstration School funds and placed in CSILE classrooms to enable teachers to directly demonstrate various aspects of the CSILE program.

- Instructional Management
  Technology-supported instructional management is not reported. Teachers use computers extensively to prepare instructional materials. Plans are underway for the implementation of portfolio assessment in Fall 1994. The technology coordinator is exploring technology tools for supporting this process (e.g., the possibility of using the scanner to enter student products).

5.0 Implementation Details

5.1 Problems Encountered [*probs*].

- Difficulties in selecting hardware/software [*pick*]
  Based on the first year of the Demonstration School implementation, it was a general perception that the district needed to allow more planning time and greater flexibility with respect to hardware/software selection. In the early phases of the project, participating schools made rushed decisions that they sometimes regretted later. While this was true to some degree at Nathaniel, the school had an advantage in terms of their general program development and their previous use of technology. Given this background, the Nathaniel school community entered the project with a better sense of where they wanted to go. The principal comments that some of Nathaniel's hardware/software choices were not always in accord with the school district's initial recommendations. For example, in the first year of the Demonstration School project, the district recommended that participating schools purchase commercial take-home systems. Nathaniel opted to purchase 78 Macs to be used in a parent take-home computer program instead. The principal does not elaborate on the district's reaction to this

choice, but the district technology and curriculum coordinator has commented that the district has moved away from making specific recommendations. Rather than providing schools with a list of suggested purchases, the district is now guiding Focus Two Demonstration schools through the process of selecting hardware and software based upon their philosophies, visions, and goals (e.g., desired learner outcomes). The time frame for purchasing equipment has been extended to allow for this decision making process.

Requisition procedures at the district level have posed a general obstacle to allowing for needed time for hardware/software selection. The assistant superintendent of curriculum and instruction comments that this is an issue of the system (i.e., the requisition process) not having changed in ways that match reform. The fact that requisition orders must be submitted by November has prevented schools from developing their "vision statements" before determining equipment needs. Several district staff and P.H. are working to alter these procedures.

- Difficulties obtaining hardware/software **[*gef*]**

The technology coordinator (J.K.) reports that the decision to devote most of the initial funds to hardware purchases resulted in limited uses of the computers initially. Budget cuts at the district level following hardware purchases prevented the school from obtaining needed software. In retrospect, J.K. feels that the school should have purchased less hardware and a greater number of selected applications up front. This approach would have allowed the school to make better use of the computers obtained, while providing them with more information and time with which to make future hardware choices (as well as allowing for the purchase of more recent models later on).

J.K. reports that the lack of software in Spanish limits computer uses at Nathaniel. She has selected programs that require little reading, such as *Kid Pics*, and math instructional games. Many of the science simulations, as well as literature and social studies oriented software products are available in English only. J.K. adds that this situation is changing as "more

- Difficulties maintaining systems [*work*]
  System breakdowns and malfunctions were cited as ongoing difficulties both with the CSILE and the Galaxy classrooms. Teachers in both projects commented that they had to be flexible in their planning and approach, given that they could plan an entire activity around CSILE or Galaxy, only to have the computer software or the fax system fail to work. During the first two years of CSILE implementation, system failures were especially frequent, due to a range of factors: software bugs and the regular installation of new versions, file server overload, wiring problems in classrooms, and lack of familiarity with operating a local network. In general, teachers seem to take this in stride, viewing this as part of the trade off involved in being a development site. However, during the second year of CSILE when there was virtually no technical support provided, the CSILE activities came to a standstill. Although CSILE teachers lack the knowledge and skill to get the system up and running when it shuts down (which appears to happen on a regular basis–three times during our one-week site visit, for example), they now have on-site technical support through J.K. When the system shuts down, teachers contact J.K. via their classroom telephone or a student messenger, and in most instances, she is able to get things up and running in short order. System failure has plagued Galaxy from the onset. Teachers estimated that the facsimile machines were down 50% of the time.

- Theft/vandalism [*crime*]
  Vandalism has been an ongoing concern at Nathaniel. A total of ten computers have been taken from the school over the past several years. The portable units are especially vulnerable and are not as well equipped as classrooms within the main building for this reason. Students cart computers into portables at the beginning of each school day and return them to the computer lab at the end of each day. The lack of ramps has made this transporting process difficult.

  The district recently installed a security system for all computers. The principal reports that the school has had no problems with theft or vandalism since the system was installed. A computer lock down system has led to difficulties of its own, however, in that each time a hard drive or a monitor is in need of repair, the school must call and then wait for a district security person to unlock the unit. This system has led to significant delays in equipment repair.

- Teacher lack of knowledge/fear **[*block*]**

  Teachers at Nathaniel are at different stages in terms of their use of technology. The technology coordinator reports that some teachers do not use equipment because they are afraid that they will break it, while others have reached a high level of proficiency. The majority of the teachers at the school have had enough exposure through participation in the lab and through classroom use to be comfortable with basic applications, such as word processing.

  J.K.: *It's something that I have wanted immediately...I've had to understand that you can't save everybody and you can't push people from the point that they are at. You can only make suggestions and show them the things that they might be able to integrate into their classrooms and if the interest and excitement are there, they pick up on it. Not everybody is going to be able to use them right away.*

- Lack of time for learning to use technology or developing technology related curriculum units **[*notime*]**

  Several teachers stated that learning how to use technology and how to integrate its use meaningfully into the curriculum requires a great deal of time and effort. Although staff development has been a priority at Nathaniel, many of the teachers interviewed comment that lack of time is still a significant issue, given their overall workloads. Those who have taken the most time to learn the technology and to coordinate its use with their curriculum have often devoted a significant number of after school hours to these activities.

  J.K.: *Staff development is really key to the teachers feeling comfortable enough using it themselves and seeing where they fit into the curriculum. I don't feel that we have had enough ongoing staff development.*

- Disappointing results from using technology **[*letdown*]**
  Not reported.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**
  Alignment with instruction has not been an issue. CSILE, Project Galaxy, and other technology implementations undertaken at Nathaniel have supported the school's educational philosophy and instructional goals. A mismatch has occurred between the timing of Project Galaxy's program delivery and the school schedule, however. As a year round school, Nathaniel follows a vacation cycle that differs from most schools. At various points in the school year, Project Galaxy classrooms were out of session when video segments were being aired. Although students were able to watch the taped programs upon returning from vacation, the mismatch of schedules limited their participation in shared activities with the Institute and with other schools. The Galaxy project coordinator hopes that Nathaniel can be matched with other year-round schools in the future, once the pilot phase has ended and the program is marketed nationally.

- Lack of funds **[*nofunds*]**
  Although Nathaniel has been quite successful in securing funds, the principal believes that much more support is needed in order to integrate technology to the extent that it should be (enabling a higher level of student access, more sophisticated applications, and better teacher support). The technology coordinator notes that funds are especially needed for upgrading memory and acquiring software site licenses.

- Resentment from nonparticipating classes/schools **[*green*]**
  The technology coordinator mentions that there was some early resentment on the part of other schools, however, as schools are added to the Demonstration project, there is greater equality through the district with respect to technology. Nathaniel is regarded as one of the successful models within the district and the educational community throughout the district has been generally supportive.

  Within the school, some classrooms are more well equipped than others as a result of their participation in special projects, such as CSILE and Project models within the district and the educational community throughout the district has been generally supportive.

Within the school, some classrooms are more well equipped than others as a result of their participation in special projects, such as CSILE and Project Galaxy. Resentment is generally not an issue, since those teachers who desire greater access to technology have had different avenues for participation. The technology coordinator notes that it is important to realize that not all teachers will be in the same place in terms of their technology use. However, their contribution to other aspects of the reform process needs to be valued: *A lot of teachers who don't have the technology are doing things that are equally important...moving our school as a whole one step further. We can't have everybody at the same place and people realize that, "Well he's got this, or she's got this, but I've got that." It's not an us or them. Everybody is doing a part.*

- Lack of technical support **[*nohack*]**
  Lack of on-site technical support was cited as a major problem during the second year of the CSILE implementation. System failures were frequent, program upgrades were confusing to teachers and required constant relearning, and needed assistance was not provided. Improved software, increased familiarity on the part of J.K. (who now handles most system failures) and the teachers, as well as additional support provided by the graduate research assistants have alleviated many of these difficulties.

  The district technology resource person for the Demonstration Schools (P.H.) characterizes the technology support infrastructure at the district level as "very lean." He states that there is a strong need for a district technology coordinator. As the number of schools participating in the Demonstration School project increases with every year, he finds that he is spread thinner and is less able to provide the technical support needed to individual sites. Nathaniel is not as dependent on district-level technical support because it has provided for a full-time, on-site coordinator.

- Failure to see fast positive effects on test scores **[*noshow*]**

The school has implemented portfolio assessment in some classrooms. At the district level, a committee is examining alternative forms of assessment.

J.K. states that Nathaniel faculty and administration have been disappointed with *"the lack of upward movement of standardized test scores. The staff feels that the children have academically improved dramatically with the advent of change in technology and content delivery in general."*

- Other **[*bug*]**

5.2 Strategies for Overcoming Barriers [*solve*].

- Inservice training/release time

District Demonstration School funds provide for ten extra staff development days. Sessions have focused on a range of issues, including technology use, collaborative learning, and authentic assessment. Teachers participating in CSILE and Project Galaxy have been provided with training within the context of these projects. The school has lengthened school days in order to end classes early every Wednesday for teacher planning and meeting time. The time is used for "circuit" meetings (to share and coordinate activities across grade levels), parent conferencing, and special projects planning sessions (CSILE, Project Galaxy, TRIBES).

A teacher notes: *One of the things we have at [Nathaniel] that I really treasure as a new teacher is collaborative planning time that's set aside for us. We have minimum days every Wednesday...the first and the third Wednesday we split up into groups that are working on different projects (Galaxy, CSILE) and we all get to collaborate with teachers who are doing things in their classroom that are similar to ours. And the second Wednesday we meet together as a circuit group, so the 4/5/6 grade teachers all meet together. And the fourth Wednesday we have time to work in our classrooms and to have parent conferences. This is the only school where I've worked, but I've talked to friends of mine who got their credentials with me who are completely isolated in their classrooms. As new teachers they don't have anyone to talk to about "what should I do about this"...or "I want to teach a unit about this"...they're completely on* *their own. And here I have teachers with so much experience and so innovative and so open to sharing ideas and collaborating, and it's just this huge treasure house. I feel like Nathaniel for me as a new teacher is a treasure house. Every door that I open I don't know what I'm going to find, but I know that there will be incredible riches. It's very exciting...I think that when I've been here for fifteen years, it will still have a lot to offer.*

J.K.: *Two of our first-grade teachers who were not using computers,...I asked to attend an Intro for Mac training provided by the district and they went and they are two of the better users this year (using CD ROM; word processor; have computers on all day instead of an hour a day). Both said the class was great...Again if you look at after school time and you say "what is first on my list?", it's often not the technology, it's all of these other things that classroom teachers need to do after their day is done... technology tends to be at the bottom of the list...So after an eight-hour class, they both felt they had a grip on how to use the computer.*

A group of teachers recently began meeting every two weeks after school to participate in a Project Galaxy staff development project. Teachers participate on a voluntary basis. They watch video segments depicting cooperative learning within classrooms, discuss what they have seen, and use the facsimile machines to exchange viewpoints and ideas with other teachers. In between video segments, they write lesson plans for collaborative classroom activities and keep journals on the implementation process.

- Involvement of outside experts

Marlene Scardamalia has provided consultation on CSILE implementation. Two of her graduate assistants have provided weekly on site support during the Fall and Spring semesters of the 1993-94 school year.

Bruce Joyce and Bev Showers have consulted with the school as a result of Nathaniel choosing the Models for Teaching school change model within the Demonstration School project. The principal states that this consultation became more valuable as Joyce and Showers adapted their approach to the level of expertise within the school.

- Creative fund raising

  Nathaniel has been successful at attracting funds through a variety of sources. The district has played a major role in directing internal and external funds to the school.

- Other

5.3 **Facilitators** ***[facil].*** Describe factors that helped this project, including:

- Technical support on hardware/software ***[techta]***

  All of the teachers interviewed pointed to the presence of a full-time technology coordinator as a key element of technology support. J.K. estimates that 20% of her time is devoted to technical troubleshooting. Intercoms within classrooms make it easy for teachers to contact J.K. immediately when there is a system breakdown. J.K., in turn, can turn to the district technology resource person for Demonstration Schools when technical assistance is needed.

  J.K.: *...that is part of my job. Every time there is a problem, I try to show them what the problem was, so that the next time it crops up (they'll know what to do)...like how to load new programs...Every time we get new things, we try to get site licenses...like we just got Kid Pics Companion...for me to go around loading it on every computer would take days and when the kids get wind that we have it, everybody wants it today...so I try to get the teachers to learn. And again, the teachers are at different levels...We've got some that say, "Fine, give me the disk." ...We've got others that just can't handle it and that's my job as teacher support to get them to the point where they can.*

  The district recently contracted with the county for the ongoing repair of hardware within schools. A county employee comes to the school once a week to pick up any equipment in need of repair. The equipment is repaired and returned to the school within a relatively short time frame (one to three weeks). The system works especially well for keyboards (which are among the most common pieces in need of repair) and peripheral devices (disk drives, cables, and mice). Monitors and hard drives are more problematic, because they are locked down and their removal requires that a district rep come and unlock them.

The district and county offices offer inservice training in technology. The district has a Mac lab and an IBM lab that are used for this purpose. Nathaniel teachers have participated in some training through the district, but most of the technology inservice is handled in house, given the on-site computer resources and expertise.

- Teaching skills (nontechnology) ***[haveskl]***
  The Conflict Resolution and TRIBES programs have played key roles in laying the groundwork for technology implementation. One teacher notes that the programs helped create a school culture characterized by cooperative learning, have helped teachers become less fearful of questioning their own practices and of change, and have provided teachers with new strategies for communicating with one another in supportive ways. Several teachers interviewed shared the perception that the integration of technology into the curriculum was eased and facilitated due to these factors.

- Technical assistance on integrating technology into instruction ***[instrta]***
  P.H. (at the district level) and J.K. (at the school level) provide teachers with ongoing support for integrating technology with the curriculum. J.K. shares new programs with teachers, and participates in curriculum planning meetings in order to identify possible links between software programs and the curriculum. Two graduate research assistants have played a similar role for CSILE teachers. This kind of support has provided teachers with new opportunities for extending their instructional goals through the use of technology.

Teacher G.W.: *The other big shift, was that when we first learned CSILE, I was trying to have my curriculum fit in with CSILE...creating units so that it would be compatible with CSILE, which now I think is backwards. Now what I want is for the technology to support what we are doing in the classroom. And that was a realization that I had this year when we were discussing CSILE with the creators and that idea came out. We are the* *"experts" on what we're doing in the classroom, so why don't we have a discussion about the archaeology project, let the CSILE people listen in and then they're the experts on CSILE and how the technology operates. After hearing what we're doing, then they can give us suggestions for how we can integrate CSILE into what we're doing and how it would enhance what we're doing, which is really how it should be. That's how we came up with how to use it with the archaeology study.*

- Supported time for teachers to develop skills ***[timesupp]***
  Through Demonstration School funds and special projects, teachers have been provided with support time for technology training and staff development.

  G.W.: *To learn a new way requires a lot of retraining. In order to do that, we need time, professional development, conferences...As teachers we are learning how to do the same thing we are trying to teach our students, which is how to work collaboratively, how to problem solve, how to think through solutions. We've got to do it among ourselves...*

- Other

5.4 Costs *[costs]*

Technology resource teacher (FT at $50,000) and computer lab aid (part time at $15,000). $10,000 per year on software and site licenses. Cost of equipment (purchased with project funds or donated) is quoted as: 98 X cost of Mac LC, 76 X cost of Classic, $2,000 satellite dish, $1,800 for 6 fax machines, $4,800 for Galaxy VCR/TVs and additional $3,200 for other VCR/TVs, $3,600 for camera and related equipment, $20,000 for CD ROMS, $1,500 for laser disk players. This does not include cost of training or CSILE staff time.

6.0 Impacts [*impact*]

6.1 Effects on Students [*kidout*].

- Motivation ***[motiv]***
  Teachers interviewed stated that students enjoy using computers as learning tools. The technology coordinator feels that students are more motivated to write at the computer, due to a variety of factors (the ease of transcription and editing, the professional look of print, the ability to bypass difficulties caused by poor motor skills). Several teachers commented that the video vignettes featured in Project Galaxy are very motivating to students. The Galaxy project coordinator comments that the video series "turns kids on to learning because they get involved in what they are seeing."

- Self esteem ***[kidestm]***
  The technology coordinator feels that students gain a sense of empowerment from learning to control the computer and to use it in ways that they associate with the real world. She observes that students are particularly proud of the products that they are able to create at the computer.

- Attendance, retention, disciplinary rates ***[kidbehav]***
  Not mentioned in relation to the use of technology. Conflict Resolution and the TRIBES program are credited with having a significant impact upon retention and disciplinary rate (six years ago when programs were first implemented).

- Technology skills ***[hackskl]***
  The technology coordinator sees a difference between how students viewed computers when their access was limited to weekly lab use and after computers were more fully integrated into the curriculum. Previously, most students regarded computers in terms of instructional games, whereas now they regard them as tools that they can master and use for a variety of purposes. Most teachers interviewed commented on the developing technology skills of their students, noting that children are not intimidated or afraid to explore the machines. G.W. notes that, "many of them are so comfortable with the technology, they're not going to have the phobia we have...they've discovered a lot."

6.2 Effects on Teachers [*tchout*]. *Include areas such as:*

- Inclination to assign complex tasks ***[hardtask]***
  Not mentioned.

- New instructional strategies ***[tchstrat]***
  The technology coordinator has observed that teachers alter their approaches to the teaching of writing as a result of the use of the word processor. Students are engaging in written composition more often, and there has been an increase in collaborative writing, student-authored

"publications" and the sharing of writing with the use of the computer as a writing tool.

The Galaxy project coordinator feels that the project has caused some teachers to examine their teaching styles, encouraging them to engage in more critical thinking and problem solving activities with the students. Several teachers comment that the technology has enabled them to build on approaches and strategies that were already in use (e.g., collaborative learning, project based curriculum). Teacher S.E. states that her approach to teaching is always evolving, and that technology plays a role in this along with other factors. In particular, she feels that the CSILE project has provided her with "an interesting way of looking at the idea of knowledge building and a student centered classroom."

Another teacher comments that CSILE has encouraged her to rethink her approach to teaching children problem solving strategies: *I feel like the more I think about CSILE the more I find my thinking expanding, so what I tell you now I expect that it will be changing. What I originally thought I was going to do was use the Make it Simple program--a program that teaches kids different problem solving strategies...I would teach them a strategy using restatement, show them how to make a graphic note, a solution section, and then a section on what they've learned...But what I'm seeing is that I want to give them much more open-ended problems and find another way to teach them the strategies because I think that the way that I have it set up now is too mechanistic...They're thinking "Oh this is how you use CSILE, you use it to solve a problem using a tree diagram." They're not getting enough of the full richness of dialogue. So I'm thinking of separating the teaching strategies and shifting to open-ended problems...That's been a real learning experience for me—very powerful.*

- Self esteem and sense of professionalism ***[tchach]***
  Several teachers talked about the sense of professionalism that comes from acting as field experts in the piloting of new programs. CSILE teachers in particular have played an active role in shaping the future development of the system. J.K.: *We have been able to talk to them about how it's working and how it's not working, what have been the pitfalls...We*

have been able to talk to the researchers themselves and the interface people (for example, explaining to them that the original interface was too difficult for students to weave their way through). In this sense, the project has provided an opportunity for teachers to experience themselves as valued professionals.

- Communication with other teachers ***[tchtalk]***
  A group of teachers recently began meeting twice a month after school to participate in a Project Galaxy staff development project. Teachers participate on a voluntary basis. They watch video segments depicting cooperative learning within classrooms, discuss what they have seen, and use the facsimile machines to exchange viewpoints and ideas with other teachers. In between video segments, they write lesson plans for collaborative classroom activities and keep journals on the implementation process.

- Use of their time ***[timeuse]***

6.3 Effects on School Climate & Processes [*schout*]

- Increased linkages with outside organizations, resources ***[link]***
  Linkages with research organizations and other schools have resulted from participation in technology projects.

- Enhanced role as magnet ***[magnet]***
  Not mentioned.

6.4 External Accountability Measures & Their Influence [*account*]

6.5 Evaluation [*eval*]

- Test scores
  In the Spring of 1992, second graders scored (CTBS) as the 8th percentile in reading, 7th percentile in language, and 14th percentile in math. The sixth graders scored at the 19th percentile in reading, 24th percentile in language and 30th percentile in math. The Assistant Superintendent of

Curriculum and Instruction reports that Nathaniel's test scores are "on par" with the rest of the district.

- Retention rates

  A district administrator states that Nathaniel has a much smaller percentage of students who have been retained or suspended, which she attributes to the school's focus on conflict management and other programs addressing the social/affective needs of the students.

- Attendance

  Attendance was reported for 1991-92 as 93%.

- Discipline rates

- Teacher turnover

  Teacher turnover is described as generally low. Nathaniel has retained a number of teachers by honoring their requests for professional growth. The teachers are encouraged to show initiative and commitment. The principal elaborates that the administration tries to keep pace with the change process by providing time and money for this effort whenever possible. "Sometimes the response lags behind the necessity, but eventually things get done."

7.0 Reflection and Advice

7.1 Dissemination [*spread*]

Nathaniel is generally recognized in the district as one of several schools that can be held up as a successful model of the restructuring process. Teachers and administrators from within and outside of the district have conducted visitations. The district technology resource person for Demonstration Schools (P.H.) is attempting to find new ways to network technology and reform leaders across sites, to facilitate sharing of information. P.H. is an active participant on statewide technology committees.

7.2 Plans [*plans*]

The district plans to continue its restructuring efforts through its Five Year Plan, adding new schools to the Demonstration School Project each year.

Five committees, each with strong teacher representation, are examining and formulating recommendations on the following issues: Technology, Outcomes Assessment and Report Cards, Staff Development, Multicultural, Middle Schools.

Both school and district are anxious to set up WANs providing students and teachers with access to on-line resources and the Internet. P.H. has a strong interest and background in networking and is working to install a district network for both administrative and instructional use. The system would involve building on the existing administrative network, which currently goes into every school. P.H. comments that, "just as instruction and assessment should be seamless, so should information data and curriculum." In a conversation following our site visit, P.H. provided updated information on the status of the network installation. The district was in the process of working with the phone company to provide direct connectivity to 30 schools (including Nathaniel) during the 1994-95 school year. The plan is for the district to construct an ethernet backbone for each school by connecting the library media center, office, and one other point of access. Schools will then be responsible for expanding to other points of access. The district will sponsor a series of staff development workshops on the use of the network (e.g., how to use the WWW server, integrating networking with curriculum). Advanced training will be provided to a group of teachers who will serve as "telementors," providing additional technical support within their schools.

The technology coordinator is working with a group of teachers, with the aide of an outside agency and consultant, on a proposal to develop a media center at the school. The center would include multiple workstations with access to Internet and other on-line resources, CD ROM, and laser discs.

Plans are currently being implemented to link Nathaniel's CSILE classrooms with other participating schools across the country. The demonstration phase of the Project Galaxy program ends with this school year. The school plans to purchase the program for the six classrooms where Project Galaxy is already in use.

7.3 Advice [*advice*]

The district technology resource person for Demonstration Schools states that the planning and implementation need to be gradual and reflective. Rather than just coming up with a plan, schools need to commit to "a deeply felt process in response to what is observed at an individual site...tied to district realities, but at the same time improving towards an ideal approach." He stresses that technology plans and purchases need to be determined based upon each school's self assessment and vision.

The school technology coordinator comments that the reform process is one of constant assessment, reflection, and ongoing change: *It's frightening in that you feel like you can't depend on anything, but it's exciting in that you feel like you have got the power to change things and to make it work...and to say this isn't working, let's stop and start over. Other advice and reflections from J.K.: Having a person in my position is key to the program. A lot of the schools in this city have no designated person, except a classroom teacher who has been interested in technology. You really need a person with more expertise who can help the teachers and is free to go to classrooms when needed...the classroom teacher doesn't have the time for troubleshooting. They need to feel comfortable with the fact that I will come into the classroom and show the kids...staff development is key to getting people to feel comfortable.. The fact that we have computers that they can take home and practice [with] before they have to have 30 kids all screaming over it...To play at their own speed. We're three quarters into the year, and some are saying "okay I'm ready...that's fine." Start small and build up...Start small with a few interested teachers, get them excited about using it [technology]...and get them to draw in other teachers...Start small with hardware but buy enough software, so there is a way to ease in and build excitement.*

The Galaxy project coordinator notes that participation in demonstration projects inevitably entails problems, but that the gains are worth the effort. She quips: *When you pilot new programs, expect there to be glitches, otherwise they wouldn't be giving you all that equipment.*

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	CSILE and the Archaeological Dig Project
Teachers:	G.W. & S.E.
Site:	Nathaniel Elementary School

1.0 Summary [*sum*]

This project description focuses on technology-supported interdisciplinary projects featuring the use of Computer Supported Intentional Learning Environment (CSILE), a communal database system, in a combined 5/6 grade classroom. An ethnically diverse class of 31 students is team taught by two experienced teachers who place a strong emphasis on cooperative learning and constructivist approaches to education. The CSILE implementation supports and extends these instructional goals, as students engage in collaborative problem solving, group investigation, and the exchange of information (text and graphics) on a shared data base. CSILE is integrated with the curriculum and is utilized across subject areas. It is used as an on-line literature circle, for collaborative problem solving in math, and within extended multidisciplinary projects. Two such projects were observed during site visits. In the first project, students "invent" a culture, then explore another classroom's invented culture through clues gathered on an archaeological dig. The second project focuses on immigration.

2.0 Classroom Context [*context*]

G.W. and S.E. team teach a single 5/6 grade classroom of 31 students. Class enrollment is ethnically diverse and is described as one of the most "well integrated" groupings within the school (six languages are represented: Spanish, Lao, Cambodian, Chinese, English, Tagalog). Each of the teachers works officially at half time, however, both put in extra hours in order to allow for overlap in the classroom and additional planning time. In addition to her role as a classroom teacher, G.W. serves as a TRIBES trainer for the district, training teachers in the facilitation of cooperative learning skills. Both teachers have extensive backgrounds in the field of education and have taught at the upper elementary level for many years. They share a similar educational philosophy, which places a strong emphasis on collaborative learning and a constructivist approach to the acquisition of knowledge. S.E. and G.W. are exceptionally articulate, reflective practitioners who discuss the role and use of technology within education in relation to a range of far-reaching issues (developmental, pedagogical, ethical).

The 1993-94 school year was S.E.'s third and G.W.'s tenth at Nathaniel Elementary. The two teachers have been teaching as a team for the past two years. Prior to coming to Nathaniel, G.W. had few opportunities to use technology, but she was open to new experiences and was attracted to particular applications (such as CSILE) that appeared to coincide with her educational philosophy and goals (*It was another piece that supported the direction that I was already moving toward*). S.E. had participated in an intensive telecommunications project at a previous school (The Children's East West Project at Blank Elementary, funded by Greenpeace) in which students in 18 schools across 9 countries engaged in on-line discussions and decision making about environmental issues. S.E. states that this experience was a catalyst for her being asked to participate in the CSILE project at Nathaniel.

Due to the school's previous reform and technology efforts, Nathaniel was selected as a CSILE development site in 1991. CSILE (Computer Supported Intentional Learning Environments) functions as a "collaborative learning environment" and a communal database, with both text and graphics capabilities. The program was developed by Marlene Scardamalia and Carl Bereiter at the Ontario Institute for Studies in Education. It has been used in a research program within a Toronto school for some time. Apple Computer provided support for introducing CSILE to a number of American schools, including Nathaniel. The program was initially implemented within three classrooms (at the 5/6 level; a 3/4 classrooms was later added). Each classroom was equipped with 8 Mac computers and one printer. Nathaniel CSILE classrooms were linked to one another via a LAN. The participating teachers were sent to an introductory three-day training session in St. Louis, where they were introduced to the CSILE model of collaborative knowledge building and where they had the opportunity to meet other CSILE teachers from across the country.

The first year of CSILE implementation was a difficult one, given the general lack of familiarity and expertise with the system on the part of the teachers, as well as problems and limitations associated with the early versions of the software. S.E. and G.W. comment that an important component of this phase of the project was the opportunity that they were given to provide feedback and to have input in the development of the software. They note that CSILE has undergone many updates and changes since it was first implemented within their classroom. This is viewed as an advantage in terms of the continual improvement of the program. However, it has also presented difficulties in that the system changes have required the constant adaptation to and learning of new sets of procedures.

Due to the discontinuation of funds, outside technical support was discontinued at the end of the first year. Lacking this support, very little was done with the CSILE system through the 1992-93 school year. Research funds were made available in 1993, leading to a high level of technical and curricular support and a much stronger program implementation. Scardamalia and Bereiter, began sabbaticals at Stanford's Center for Advanced Studies in the Behavioral Sciences in the Fall of 1993. Their two graduate students have spent two days per week at Nathaniel during the Fall, Spring, and Summer semesters, providing direct technical assistance and facilitating the integration of CSILE into the curriculum. In addition to their individual classroom support, the graduate assistants meet with Nathaniel teachers as a group on a twice monthly basis. During the meetings, teachers discuss their curricular goals and possible matches with CSILE are suggested. S.E. and G.W. state that this level of support has been instrumental in their ability to integrate CSILE more meaningfully into their curriculum.

Teacher Quotes:
S.E. on impact on practice: *My approach to teaching is always changing, and it's not exclusively because of the computer. CSILE has been an interesting way of looking at the whole idea of knowledge building and the whole idea of a student centered classroom.*

G.W. on technical/curricular assistance: *This year the technology support is provided...last year we didn't really use it because of all the upgrades and no support. For example, if you turn it on and it doesn't work, I can't figure it out and we don't use it. The other big shift, was that when we first learned CSILE, I was trying to have my curriculum fit in with CSILE ...creating units so that it would be compatible with CSILE, which now I think is backwards. Now what I want is for the technology to support what we are doing in the classroom. And that was a realization that I had this year when we were discussing CSILE with the creators,* *and that idea came out. We are the "experts" on what we're doing in the classroom, so why don't we have a discussion about the archaeology project, let the CSILE people listen in and then they're the experts on CSILE and how the technology operates. After hearing what we're doing, then they can give us suggestions for how we can integrate CSILE into what we're doing and how it would enhance what we're doing, which is really how it should be. That's how we came up with how to use it with the archaeology....Because I don't know what the system is capable of I can't come up with ways to use it in innovative ways, so it's better for us to continue our discussion and have them make suggestions.*

3.0 Reform Features [*feature*]

Y Interdisciplinary
Y Project-based
Y Collaborative Learning
Y Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach

Notes:

Mixed Age. G.W. and S.E. team teach an ethnically diverse mixed age group of 5th and 6th grade students.

Interdisciplinary/Part of Core Program/Extended Activity. CSILE has been integrated with the curriculum across a range of subject areas. During the 1993-94 school year, CSILE has been used for collaborative problem solving in math, as an on-line literature circle ("Book Talk") for sharing information about books, and as a vehicle for constructing and communicating information about the cultural universals (e.g., language, housing, values) that students create within the interdisciplinary DIG project. Book Talk is an ongoing activity (involving all four CSILE classrooms) through the school year. The DIG project is an extended activity that lasts about eight weeks and takes up large portions of the school day (involving two 5/6 classrooms). The project incorporates all aspects of the curriculum (reading, writing, social studies, math, science).

Collaborative Learning/Project Based/Teacher as Coach. G.W. and S.E. place a strong emphasis on student collaboration. As a TRIBES trainer, G.W. trains other teachers in the use of cooperative learning groups. Within the DIG project and throughout the curriculum, students work on project-based activities in small groups. The group process itself is a focus of instructional support, as the teachers coach students in the skills of listening, providing constructive feedback, appreciating the contributions of others, and sharing responsibility for tasks. Both teachers view their roles in terms of the orchestration and ongoing facilitation of this collaborative learning process, as opposed to a teacher directed model of knowledge dissemination.

4.0 Description of Activity [*activity*]

Technology Use Within the DIG project. During the 1993-94 school year, S.E. and G.W., in parallel with another 5/6 CSILE classroom, organized their curriculum and a series of project-based activities around the interdisciplinary theme of "ancient civilization." For the initial extended project, they drew from a simulation curriculum called DIG (developed by Interact), in which students invent their own ancient civilization, creating artifacts, symbols, and values. The project began in September with the class discussing "what makes a culture." G.W. describes: *First we talked about culture, the different aspects that make up culture, which we call culture universals. So we looked at housing, language and food, transportation, values, government system. We looked at it within our own culture and then we invented our own culture.*

Working in small groups, students created their specific cultural universals based upon the overall values and the geographic location that was decided on by the class as a whole. The class selected the care of the environment as their culture's overriding value or "theme" and they located their culture in the rain forest. The students studied images of animal and plant life on a rain forest laser disc to ensure that *whatever they were making*...[was] *true to a rain forest environment* (G.W.). Once these aspects of the culture were decided, students began generating their cultural universals. Using CSILE as a shared database, students wrote text and created graphics that described and depicted their cultural universals. They created links between entries that were conceptually connected (most often linking a text with a corresponding graphic image). Many of the Spanish speaking students entered their notes in their primary language, which they then linked to an English translation. Throughout this process, students read and responded to one another's emerging plans and ideas using "helpful, thoughtful" comments.

> CSILE entry on Number system:
>
> This is the slaminan's number system. It is a basic
> 10 number system too. It has a pattern to it. The
> number of lines increase up to five then it goes
> upside down all the way to 10.
>
> [Above text entry is linked to an illustration of the number system]
>
> Comment posted on CSILE from the "ritual group":
>
> We all like the number system, but we want
> to know how the number 0 looks like, and you can
> do more numbers not just ten like we have right now.

As each group created their piece of the culture (e.g., clothing, language, housing), they needed to make sure that it was consistent with the overall culture. This required a high level of coordination and communication between the individual working groups. CSILE facilitated this process by providing students with a means for sharing their developing ideas quickly and easily. S.E. comments: *One of the ways we used CSILE...student groups created graphic and text notes to explain what their cultural universal was. Then other students could access that and comment back right away, and say "Wait a minute, you can't make a boat out of a tree because our culture doesn't cut down trees!" So then they entered into a discussion about other materials. Students in this way could analyze and discuss what was being developed.*

In addition to their CSILE entries, students created murals, three-dimensional scenes, and an array of artifacts (e.g., toys, pottery, jewelry) representing the various aspects of their culture. One of the student groups was charged with the task of creating their culture's rituals – one for rite of passage, one for marriage, and one for death. Students posted and discussed their proposed rituals on CSILE (see excerpts below). Using scripts that they had written and wearing costumes based upon what the clothing group had designed, they documented the rituals on videotape. All of the artifacts, including the video, were buried in a plot outside of the classroom, left as clues for another classroom to excavate and piece together.

CSILE Student Entries in DIG Project

TOPIC: Archeology Marriage&FamilyGroupings

MARRIEG CE. BY MAXIL

CEREMONY: THE MAN FALL IN LOVE WITH THE GIRL AND HE OFFERS HER A POT WITH A JAVA SEED IN IT AND IF SHE EXCEPTIT THEY CAN GET MARRIED, BUT THERE IS A CATCH TO THIS. YOU MUST BE ASKING WHAT THE POT IS FOR. THE JAVA SEED MUST HAVE DEVELOPED A JAVA LEAF WITH IN A MONTH, BUT IF IT HASN'T DEVELOPED A LEAF THEY CAN'T GET MARRIED, WITH THE SAME PERSON. YOU DON'T HAVE TO GET MARRIED WITH SOME ONE THAT YOU DON'T WANT TO MARRIE AND IF YOU DON'T FIND THE PERSON THAT YOU WANT TO GET MARRIED WITH THEN YOU DON'T HAVE TO GET MARRIED AT ALL.

[Text is linked to illustration of "Engagement Plant"]

comments

I thik the marrig saramony is intisting but what if it grows befr the end of the moth we thik you
shold keep this idea.

frrom jamedra and Emmanuel

to Jemmedra and Emanuel

Dear Jamedra and Emmanuel,
I think you have mistaken the way the ceremony goes if the leaf doesn't grow in a month then they can't get married, if it grows then they can get married.

Sincerely,
Video Group

Archaeologists (students from a local university) assisted students with the preparation of topographical maps, and with the burying and retrieval of the artifacts. The excavation site was prepared to scale, with the students staking out the lot and dividing it up. Once all of the artifacts were buried, the two participating classes excavated one another's sites. Each artifact was carefully removed, cleaned, and recorded, using the tools of an archaeologist's trade. Once the site was completely excavated, students met in groups to discuss their findings and to begin generating theories about the newly discovered culture. They entered and responded to one another's theories through text notes on CSILE. As a final activity, the two participating classrooms were brought together to discuss their theories and to present their respective cultures.

In addition to the subject areas and the specific technology skills that are addressed within the project, G.W. feels that the DIG project has provided students with important insights into the nature of culture and diversity: *It's given them the tools in which to look at the different cultures represented in our class, which is fabulous. We often see students picking up a National Geographic magazine and looking at a culture in the Amazon and seeing something that is so different–they laugh and make fun of it. Now they look and they know there has got to be a reason...What is the reason they have this ceremony or that jewelry?...So it's given them the tools to look at cultures around the world and within the class, which is a goal for our class, to appreciate the diversity...technology really enhances this...This goal is interwoven in everything we do.*

Following the DIG project, the next phase of the curriculum was to study real (rather than hypothetical) ancient civilizations. Students were again divided into small collaborative working groups, conducting research on various aspects of the Egyptian culture. At the time of our final site visit, CSILE was being used by students to present and discuss their research problems and questions. Discussions on CSILE included the following student- and teacher-generated topics: "Why did they build pyramids?" "What did they do to write numbers?" "What are the government and laws of Egyptians?" "How many cat gods were there?/Why are they so important?" Drawing from a variety of sources, students participated in these lines of inquiry through lively discussions on CSILE (see excerpt below).

CSILE Excerpt: Student entries on "Why did they build pyramids?"

> I think that they build the pyramids is because So t the theifs can't steel their golds. (JL)
>
> I don't think that they just build pyramids so that they wouldn't steal there gold. I think that they also build them for like homwes for the dead people. and I don't think that the Egyptian just thought about stealing only... (MM)
>
> I agree with you becaues right after I finish typeing on csile I went to Research and I read a book on pyramids. It says that they build the pyramids for keeping theifs away from their golds and stuffs that meen alot to them. And the pyrmids are for the Kings and Queens. When the kings or Queens die... In the pyramid has a tomb. You know whats a tomb right? then you know what happens.
>
> ...I disagree with you about you writing about the pyramids. Pyramids are build not for theifs so that they couldn't still. They are build to put things that are important to them. They wouldn't think that their people would do that to them. (PS)

S.E. views CSILE as a springboard and a vehicle for engaging in the research process, helping students to organize and extend their thinking through collaboration. She outlines a progression in the process that begins with the student identifying the issue or topic, then building from there: *...these are things I want to learn more about, then get ideas (actions) and resources (where to go for information) from other students on line and start a dialogue as they get information and start to piece it together.* This process developed over the school year, as students became more familiar with the activity of conducting collaborative research and with the workings of CSILE. In addition, the teachers (with the assistance of the graduate students assisting with CSILE) were able to monitor the use of CSILE (through direct observation and study of CSILE files) in order to identify areas where further support was needed. For example, in the context of a unit on immigration (described below), teachers provided mini-lessons on various aspects of CSILE such as: the use of keywords (e.g., how to assign them, how to retrieve information using keywords), how to take notes and cite them, how to link important data to their discussion note. By the end of the school year, students appeared to have grown tremendously in their understanding and use of CSILE as a tool for collaborative knowledge-building. Their commenting and discussion entries became more sophisticated, as did their use of key words and linking to build and retrieve related information.

After completing the unit on ancient culture, students went on to study immigration. This interdisciplinary unit extended the focus on the social issues (e.g., cultural diversity) that were raised in the preceding units. The unit began with two overarching questions: "Why do people migrate?" "What is the impact when two different cultures come together?" These questions were addressed through a variety of activities including simulation and role play, literature studies, personal research regarding family histories, debates regarding recent immigration legislation (AB 187), and collaborative research on selected topics. A "Migration from Latin America" simulation (based on curriculum developed by SPICE) involved the exploration of immigration issues from the perspective of six countries (Cuba, Guatemala, El Salvador, Mexico, Haiti, Dominican Republic). An activity focusing on immigration within Tom Snyder's simulation software "Decisions, Decisions" was also used. A study of the history of Angel Island culminated in a field trip to the historic site. G.W. and S.E., having recently participated in training on reciprocal teaching, used this instructional approach to guide students through the process of leading critical discussions on key readings (e.g., articles on immigration struggles and current legislation).

As with other units of study, immigration research questions and issues were entered and discussed on CSILE. In addition to their family histories and literature topics, discussion centered on a set of selected research questions (e.g., What problems did immigrants face upon arriving in the U.S.? What impact do immigrants have on the U.S.?). When entering their responses to the questions, students identified whether their text was a request for information or a statement of information based on either their personal understanding or an outside information source. All information sources were cited and students were encouraged to use one another's CSILE entries as referenced information sources. This approach led to a more explicit form of collaborative knowledge building, as students learned to cite one another's entries in the process of making their own arguments. CSILE supported this activity by enabling students to access and review one another's work readily, as well as by providing an organizing structure that allows students to make key connections and link their own learning to the learning of others. In our final site visit at the end of the school year, S.E. indicated that this was one of the most impressive aspects of what technology, through the use of CSILE, was able to provide.

CSILE Use as a Literature Circle. Another way that CSILE is being used is to create on-line literature study circles or "Book Talks" in which students discuss the books that they are reading. Students start a discussion about a book they have read by entering a summary, an opinion, and possibly a question about some aspect of the book that they did not understand or that they disagreed with. Other students can then read the entries and respond with their own ideas and opinions. In addition to entering the name of the author and the title of their books, students can list key words related to the themes or topics that are addressed. When searching the Book Talk database for information, students may use a range of retrieval strategies (e.g., by author, by topic, by student). The week of our site visit, an entry regarding the book Jurassic Park had generated a string of responses. Teachers and students were excited about the possibility of expanding their discussion about books to other classrooms.

G.W.: *In our literature circles we have discussed racism and a lot of personal issues. These are going onto CSILE [and the dialogue is expanded]. We do a lot of reading and don't have a chance to discuss each book with everyone. Now they can discuss books over CSILE and that can happen between three, four, or five students.*

5.0 Technologies Involved [*types*]:

Y Microcomputers [9 Mac computers linked to one another and to other Nathaniel CSILE classroom computer via a LAN]
Y Word processing [word processing is a component of CSILE, students also use *Microsoft Works*]
N ILS
N WANs [Note: Plans to install a WAN linking CSILE classrooms across the country are under way]
Y LANs [Links computers within Nathaniel CSILE classrooms]
N Spreadsheet
N Hypermedia
N Animation

Y Simulation [*Decisions, Decisions* – a simulation program on immigration]
Y CD-ROM [In Nathaniel computer lab, can be brought into classroom when needed]
Y Interactive videodisc [In Nathaniel computer lab, can be brought into classroom when needed]
Y Videocams and editing equipment
Other: Database [CSILE functions as a communal database]

6.0 Technology Use

- Student Uses **[*kiduse*]**

Tutorial ***[tutor]***

Students have used *Type to Learn* to gain familiarity and skill with the keyboard. Tutorials and instructional games are available in the school's computer lab. However, the program emphasizes other uses of technology. S.E. feels that using computers as "electronic workbooks" for drill and practice and for instructional games is, by and large, a poor use of this resource.

I see so often what I consider incredibly wasted opportunities with the computer...Why put all that money into the computer when a workbook does it just fine? [Classrooms described in article on computers] were playing Jeopardy. You don't need a computer for that! It's such a linear way of thinking, to take exactly what you already do and you put it on the computer. My view of technology is ...complicated. It's not smooth and it's not predictable outcomes. It's not a prescription. We're constantly experimenting and we're not always sure what's going to happen with the experiment. There is a loss of control, but out of that some very exciting things happen. I see that computers can be used in many ways and the majority of times they're used in ways that don't really enhance anything.

Exploratory ***[explore]***

Yes. Simulations and other exploratory programs, such as LOGO, are used in the school computer lab. Students explore and gather information on particular topics (e.g., the rain forest) using laser discs. During the 1993-94 school year, students were using Vanderbilt's *Jasper* laser disc series in conjunction with CSILE to engage in a project in which they designed a playground. Tom

Snyder's program, *Decisions, Decisions* has been used as a simulation within the immigration unit. CSILE itself is an exploratory application in the sense that students may freely browse through multiple levels within the program (e.g., text and graphics entries linked in various ways and focusing on a range of topics). For example, within the Book Talk database, students can browse through entries submitted by students in four different classrooms (3-6 grade). The range of entries includes summaries, reviews, and questions corresponding to a variety of books. Students can conduct key word searches in order to locate books that address specific topics, and genres (e.g., monsters, teenagers, mysteries).

Communication ***[commtn]***

Yes. Students within Nathaniel's CSILE classrooms communicate with one another through the database. The system allows students to enter their notes, theories, and opinions, which are then responded to and/or linked with other students' entries. In addition to text, students can create diagrams and colorful graphics to communicate their ideas. The idea behind CSILE is that through such communication students will construct a communal knowledge base, as they make their knowledge explicit, are provided with other perspectives to consider, and engage in collaborative problem solving. The instructional support surrounding CSILE emphasizes the use of "thoughtful, constructive commenting"– a particular form of communication that enables students to respond critically and supportively to one another's work.

Plans are currently underway to incorporate the use of telecommunications into CSILE activities (currently planned for implementation during the 1994-95 school year). Once the WAN is installed, Nathaniel CSILE classrooms will be linked with other CSILE sites across the country.

Tool ***[tool]***

Yes. Word processing and database activities are the primary uses of technology within this classroom. Students spent one half hour each day on CSILE, entering text or graphics into the database and reviewing and responding to other students' entries. In addition to the writing that occurs on CSILE, students use *Microsoft Works* as a word processor for other classroom writing activities. Within the DIG project, video cameras are used as tools to document various aspects of the cultures that the students have created (e.g., rituals).

- Teacher Uses **[*tchuse*]**

  Communication
  During the first year of CSILE implementation, participating schools were given e-mail accounts and were linked with a few of the other CSILE sites across the country. Nathaniel's modem was located in the school's computer lab and was used infrequently by the teachers. During the 1993-94 school year, Quickmail was installed in the CSILE classrooms, enabling the teachers to communicate more readily with their colleagues and with CSILE researchers and developers.

  Presentation
  District funds were used to purchase an overhead projection system for each of the school's CSILE classrooms. S.E. and G.W. use this system for group demonstrations and mini lessons on the functions and procedures of the CSILE system.

  Instructional Management
  Both teachers commented that the ability to print out student work provides them with a tool for monitoring student learning and progress. Ongoing records of the exchanges that occur between students on CSILE have aided S.E. and G.W. in their facilitation of the collaborative process. (*We did mini lessons on what was a helpful, thoughtful comment...then we had the data to look at and analyze and ask 'What does this tell us? Did it further the dialogue?' It helped us continue [to support] the dialogue on a higher level*)

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration
  Yes. G.W. and S.E. place a strong emphasis on student collaboration. As a TRIBES trainer for the district, G.W. trains other teachers in the use of cooperative learning groups. Within the DIG project and throughout the curriculum, students work on projects-based activities in small groups. The group process itself is a focus of instructional support, as the teachers coach students in the skills of listening, providing constructive feedback, appreciating the contributions of others, and sharing responsibility for tasks. Both teachers view

the computer as a vehicle for supporting and extending this collaborative process. CSILE is designed to support collaborative knowledge construction. One of the design principals underlying CSILE is to "give students more responsibility for contributing to each other's learning" (Brett & Oliver, 1991 p. 14).

- Independent exploration

  Yes. G.W. and S.E. were attracted to CSILE because it allows for a great deal of independent exploration (as opposed to the directive format of tutorial software).

- Access to outside information resources

  Yes. CSILE has not been used in conjunction with telecommunications, although plans are currently underway for adding this component. However, students have accessed other students within Nathaniel's CSILE classrooms as "outside information resources" in the construction of shared databases.

- Support for higher-level thinking

  Yes. S.E. and G.W. regarded the use of CSILE within the context of project-based activities such as DIG as a way to facilitate the development of higher-level thinking skills and "knowledge building." The CSILE teacher manual (Brett & Oliver, 1991, pp. 14-15) lists a series of principles that guided the design of the program, including:

  - Making knowledge construction activities overt (metacognition).
  - Encouraging multiple passes through information (integration and synthesis of information)
  - Facilitating the transfer of knowledge across contexts.

- Creativity

  Yes. Creativity is an important component of the DIG curriculum and the use of CSILE extends this aspect. Students create their own cultural universals, artifacts, and rituals, using a variety of different media, including the graphics capabilities within CSILE.

- Technology skills

  Yes. S.E. and G.W. value the development of technology skills as a critical aspect of preparing students for life in the 21st century. They feel that the use of technology within the classroom will be most beneficial in this respect if it mirrors the uses of technology within the real world. Thus, technology skills are learned and valued as a means toward accomplishing authentic tasks, rather than being taught in an isolated fashion, "as an end in itself."

8.0 Realized Benefits of Technology [*kidout*]

- Motivation ***[motiv]***

  Both teachers state that their students are very motivated to use the computer for a variety of tasks. During our classroom observations, a high level of motivation and interest was evident.

  S.E.: *The computer has been an empowering tool to the students. They have a voice and it's not in any way secondary to anybody else's voice. It's an equal voice. So that's incredibly positive. Motivation to use technology is very high. Students really enjoy using the computer as a learning tool.*

- Attendance, time on task, discipline ***[kidbehav]***

  Not mentioned. Students observed during CSILE/DIG activities were clearly invested in the tasks at hand.

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  When either S.E. or G.W. discusses the impact of the use of the computer within their classroom, the theme that repeatedly emerges is the facilitation of student collaboration and communication. This is a focal point within their program, and a most valued aspect of CSILE. The teachers feel that the groundwork for the cooperative skills that have been furthered through CSILE was first provided through their work with students in conflict resolution and the TRIBES program. Based on these approaches, social skills and group process are explicitly modeled and coached, in relation to the use of CSILE and other collaborative project-based activities.

S.E.: *First of all...social skills are explicitly taught and stressed – what it looks like and feels like to attentively listen and to share and to cooperate. Secondly, when we introduce CSILE and the concept of a comment, we have overheads that we developed and use which go through nice comments, put downs and helpful, thoughtful [comments. We] make it clear that we don't just want nice comments. We talk about, to disagree, is that a put down? We talk very specifically about helpful thoughtful comments--that they push people's thinking, they question things, they disagree if that's necessary, they give support. But they do it in a helpful way. They don't just say that's stupid, which is not very helpful, or that's nice, which is also not very helpful. Because some of the kids have been with us for three years, they're outstanding at it...ninety percent of the comments have been helpful, thoughtful.*

Within the DIG project, students work in small collaborative groups to create a piece of the culture that they have taken responsibility for (e.g., language, number system, clothing). This information needs to be shared quickly and easily with the other groups, as each aspect of the culture is intertwined with the rest. CSILE has provided a useful mechanism for the exchange of information within this context. G.W.: *For the DIG project, a lot of [the students] wrote messages in Slaminian, which is the language they created, and they were able to access this immediately. There was no way that the two students who created it would have been able to meet with everyone and explain it, so it made it easy and quick. Students were using it to work on their own universals, which are all connected in some way. So students working on dance could access what the costumes should look like. Through the computer, they were able to communicate all this with one another.*

Both teachers comment that the linkage across classrooms has opened up new possibilities for collaboration and dialogue between a greater number of students (i.e., across classrooms), thus providing a broader range of perspectives and information for students to consider (G.W.: The *computer opens up the possibilities so much more than [face to face]...we have three other classes that can enter into this dialogue*). In some cases, exchanges occur between students that might not otherwise take the time or put forth the effort to communicate with and learn from one another: They *[are] able to communicate. They do* *comment, "your idea made me think about this aspect..." ...hearing different voices and different perspectives through the computer where they might not be able to talk to each other [face to face] in such an intimate way.*

G.W. describes an exchange that occurred between two students during the first year of the CSILE implementation (the year before G.W. and S.E. began team teaching). The exchange was between a Latino girl in S.E.'s 4th grade and a Mien boy in G.W.'s 6th grade class. The students within the two classes were engaged in a discussion over CSILE on the death penalty, entering and responding to one another's opinions. The younger student entered a comment about God (something along the lines of "It doesn't matter because God will take care of it"). The 6th grade boy responded with a heartfelt message ("...I don't think there is a God, if there was he wouldn't have let my brother drown"). The two students entered into an in-depth discussion about life, death, and the existence of a deity. G.W. commented that this level of dialogue would never have occurred in person, especially given the gender and grade gap between the participants.

S.E. feels that the use of computers further supports collaboration among students because of its influence as an equalizing force within the classroom:
It seems like students feel equal around a computer—there's something about it, maybe because it's new and they haven't been tracked...They haven't defined who is good and who is bad on the computer and they all feel equal around it.

- Ability to manage own learning ***[selfreg]***
  G.W. and S.E. observe that, through the comments and questions of other students, their students are able to see the gaps in their own thinking and understanding. They are then able to focus their study on a specific area and to conduct further research to develop their ideas and to make these ideas explicit within text.

- Access to outside information resources ***[outinfo]***
  Students have not had the opportunity as yet to access outside information resources via telecommunications. However, within CSILE, students utilize one

another (within and across classrooms via a LAN) as information resources as they construct collaborative databases.

G.W. addresses current plans to integrate the use of telecommunications into the curriculum: *Connecting through computers with the outside world [will be a new direction]. Why should we have to bring in someone from the outside all the time? For the DIG project, we brought in an archaeologist to show us the tools and [to supervise] the dig...some of the kids were really motivated. Some want to be archaeologists. We are going to a museum on a field trip...but we could also be networked with them or with the archaeology department at the university. We could access what they have on computers, pictures of artifacts, digs, etceteras. It's unreal to bring others here.... We can use the real world to learn about these things and the computer can facilitate this.*

- Support for higher-level thinking ***[higher]***

  Yes. Technology is used to support a range of tasks that involve higher-level thinking skills, including: written composition across a range of genres, summarizing and synthesizing information, developing strategies for retrieving and organizing information (e.g., key words, links), generating hypotheses, engaging in critical reading and constructive criticism.

  S.E.: *There's a lot of high level knowledge embedded in it that they're not even aware that they are using. They have to produce summaries...All these things we used to teach out of a workbook and it didn't make any sense. Here it's a direct application. They need to be able to do some of these applications in order to access something. So it's automatic that they learn how to do it because they want to be able to access. Like with the Book Talk, they apply key words to their summaries, so that someone can scroll through and see, 'Now here is a book on family problems...' So making that kind of link, being able to synthesize your thoughts...there's actually an application on CSILE for linking, so they can link one note to another, talk about what the connection is.*

- Complexity of task students can accomplish ***[taskacc]***

  Yes. CSILE enables students to share and build on one another's knowledge quickly and easily, and this in turn leads to more complex tasks and products.

Students have access to multiple perspectives and are given an opportunity to reflect on one another's comments before responding. They access and organize information flexibly and in a variety of ways (by author, by student, by topic).

- Learning on specific tasks ***[kidlearn]***
  The CSILE activities that have been implemented thus far have supported a range of specific tasks or areas of learning, including:
  - Language skills
    S.E.: A lot of the students who speak Spanish are writing their notes in Spanish and then making a link to the English translation.
  - Communication skills
    First of all, it's an opportunity for kids who aren't comfortable speaking up or speaking out loud in front of a big group to air their ideas. It gives kids time to think through something before they are forced to respond. I think people oftentimes face to face don't listen very well, they interrupt, they cut people off, they're thinking about what they want to say next. The computer allows opportunity to read, to reflect on what has been stated and then to respond in a much more coherent thoughtful way.
  - Basic skills in reading
    S.E.: I feel that it also increases basic skills--there's a lot of reading, there's a lot of text. They learn how to synthesize information. They have to assign key words and then they have to retrieve notes using key words and topics. In Book Talk, students practice summarizing text and then clarifying information that is unclear to them in the story.

- Creativity ***[create]***
  Yes. Within the DIG project, students have used the graphics capabilities within CSILE to create colorful drawings and diagrams depicting various aspects of their culture. The generation of culture universals is a creative process that is facilitated by the sharing of ideas via the communal database.

- Greater attention to how a product will be understood by others ***[audience]***
  Yes. The activity of building a communal database involves the ongoing need to clarify and elaborate one's ideas.

- Technology skills ***[hackskl]***

  Yes. Students are acquiring technology skills in the context of meaningful tasks. With 9 computers and 31 students, there has been a high level of individual access, as well as an instructional stress on "equal access" (a minimum of 30 minutes per day per child). This has led to a basic level of technology skill on the part of all of the students. Some of the students have been using the technology for several years and have becomes especially proficient. S.E. comments that students range in terms of their technology skills and abilities. *Some students can do a lot more in there computer time then others. Student training has consisted of students training other students, class lessons using overheads, adults roaming the classroom and working with individual and paired students at the computers...Some of the students have used it for three years, others for two, others are new. The ones who have used it from the beginning have become peer coaches.*

  G.W.: *Many of them are so comfortable with the technology. They're not going to have the phobia we have...they've discovered a lot.*

CLASSROOM LEVEL DEBRIEFING FORM

Short Title:	A Galaxy Classroom
Teacher(s):	M.B.
Site:	Nathaniel Elementary School

1.0 Summary [*sum*]

The Galaxy Classroom Project was developed as a nation-wide reform effort designed for at-risk elementary school students. As part of a two-year demonstration phase thirty-seven inner-city urban and isolated rural area schools throughout the United States and Mexico are linked by an interactive satellite telecommunications network. Galaxy broadcasts a television program to each of these classrooms where teachers are provided with curriculum guides, hands-on materials, and take-home kits related to the content of the program. Each classroom is equipped with a fax machine, television, VCR, and audioconferencing telephone.

Over the past two years Galaxy has offered programs in two content areas: language arts for 3-5 and science for grades K-2 and 3-5. During our visit, in the Fall of 1993, three classrooms at Nathaniel Elementary School were involved in the 3-5 science curriculum. This science program incorporates curricula from Full Option Science System (FOSS) and Great Explorations in Math and Science (GEMS) developed by Lawrence Hall of Science. Television broadcasts serve as springboards for "hands-on, minds-on science," experimentation, problem-solving, and communication of observations with other Galaxy students across the continent. Through this program the Galaxy Institute seeks to promote scientific inquiry that is relevant to students' lives, as well as the construction of meaning through observation and exploration. While providing the opportunity for students to develop skills related to scientific inquiry Galaxy encourages teachers to expand Galaxy activities to involve math, language and social studies. Technology is used as a motivation for exploration and writing and as a vehicle for telecommunications. Computers are also used as a tools for writing.

2.0 Classroom Context [*context*]

Teacher Background M.B. is in his fourth year of teaching at Nathaniel. He first taught PE, then a combination third/fourth for one year; he has been teaching a combination fourth/fifth for the past two years. M.B. heard about Nathaniel during his teaching program and was attracted to the interesting programs in progress there.

M.B. had no experience with technology until just before he started his teaching program: "I kind of ran from computers most of my life until about a year before I started my credential program." This is his second year with the Galaxy program; last year he was involved with the Galaxy language arts curriculum.

Class Composition There are thirty-two fourth and fifth graders enrolled in M.B.'s 1993-94 class. Over half are Cambodian, the rest are Vietnamese, African-American, or Native American. All of the Cambodian students are at least limited proficient in English and have been in the States for five years; most were born here. Fewer than half of M.B.'s students are on grade level in reading; five are at a first grade reading level.

Technology in Classroom and Student Computer Access Each classroom has a fax machine linked to a satellite network, a television, a VCR, and a "hoot 'n holler" (audioconferencing telephone) provided by Galaxy. The hoot 'n holler can be used by teachers or students to speak with Galaxy classrooms all over the country. It is an open line that is used by simply speaking into the phone and waiting for a response.

As part of the two-year demonstration phase Galaxy allocated one video camera and one Macintosh computer to each school involved. Due to Nathaniel's status as a district Demonstration School, M.B. also has three Macintosh computers and a dot-matrix printer. Each student has one hour of scheduled time on the computer each week, and the whole class has an hour a week in the school's computer lab. M.B. uses the computers primarily as a tool for writing; there is usually not enough time for each student to compose on the computers, so this scheduled time in the classroom is used for the revision of drafts. The computers are also used for a math station, as part of a rotation, during math time. Two students work together on one computer during these rotations.

M.B. is adept at problem-solving with computers; the other Galaxy teachers often come to him for help. He has his students help each other with problems on the computer. His message to students is "Don't be afraid of it... you don't have to know it all to use it."

3.0 Reform Features [*feature*]

Y	Interdisciplinary
N	Project-based
Y	Collaborative Learning
Y	Mixed Age
Y	Extended Activity
Y	Part of Core Program
Y	Teacher as Coach
+Y	Thematic Curriculum
+Y	Student-centered curriculum

Notes:
The Galaxy science program is an interdisciplinary, thematic curriculum that is integrated around themes related to scientific inquiry. (The language arts curriculum focuses on themes related to interpersonal issues.) The activities in the science program's teacher guide suggest that students work in collaborative groups to work with hands-on materials and generate hypotheses. As "SNOOPS," or detectives, they do group experiments (observe, measure, calculate, hypothesize, discuss, analyze) in order to solve mysteries posed on the satellite televised show. Writing is a key component of this process as the students write up their observations and prepare faxes that communicate their findings.

Many of the activities can be extended to last several days or weeks, if the teacher chooses. The FOSS and GEMS teacher guides include several sections with ideas for extensions of activities into other areas of the curriculum. M.B. has spent several weeks using Galaxy as a math curriculum and claims "You could focus your language arts and everything around it." Another Galaxy teacher echoed the interdisciplinary nature of Galaxy; he described to us how he was able to expand on themes from an episode about the Anasazi Indians, which involved science and social studies, to include math (looking for patterns), art (creating a mural), and reading.

Teachers are encouraged to act as coaches by helping their students "pose their own questions and seek their own answers" ("Galaxy Classroom," Galaxy Institute for Education).

The Galaxy science classroom is based on a student-centered, constructivist approach to learning. The Galaxy Institute describes this approach as one that views learning as a personal process, acknowledges that kids bring a wealth of experiences to the classroom, believes that these experiences form the foundation for students' understanding, and encourages students to expand their thinking, build bigger ideas, and construct knowledge that has relevance to them (from "Teacher's Overview for Galaxy Classroom Science Program").

4.0 Description of Activity [*activity*]

The Galaxy Science 3-5 curriculum runs in three six-week cycles including a total of 12 television broadcasts in 18 weeks. The three themes covered are "Science is Finding Patterns as Evidence," "Doing Experiments to Describe and Compare Materials," and "Building Models to Explain and Invent Ideas." Specific curriculum goals are outlined in the Galaxy teacher's guide for each theme, or arc, and in the teacher guides that accompany the FOSS and GEMS activities. For the first arc, "Science is Finding Patterns as Evidence," curriculum goals include using patterns as evidence to solve mysteries, making observations and comparisons, exploring patterns of "hidden evidence," and exploring patterns that can help reconstruct the past.

Activities for the second arc, "Doing Experiments to Describe and Compare Materials", involve observing and identifying properties of materials, inventing ideas by performing experiments, making comparisons, looking for patterns, communicating with others to verify, revise, and expand upon ideas, and creating one's own ideas based on verifiable evidence. After viewing each broadcast, students pursue questions raised by television SNOOPS as they travel across the country with their teacher. In the second arc the SNOOPS are seen in Piermont Marsh, New York, attempting to decipher a mysterious message written in the mud. In the storyline that follows, questions are posed to the SNOOPS in the schools: How can you walk on the mud without the mud getting all over you? What makes the mud [in this marsh] smell? How can we find out what's in the mud? What's killing all the animals? How can we get oil off of water? Where is the mysterious substance coming from? The students hypothesize answers based on group experiments, observations, and large group discussions.

At various points during the broadcast students are invited to fax their ideas or observations to their partner schools (the Galaxy schools they are paired with for the project). Nathaniel's partner schools were located in Massachusetts, New York, and Florida. If students fax their responses to the television SNOOPS in time, they have an opportunity to see their answer incorporated into a later broadcast, or printed in the SNOOPS magazine posted to each school via fax machine. This is viewed as a particularly motivating aspect of the program, according to the students that we interviewed.

We observed at Nathaniel during the second arc, "Doing Experiments." During our observations of S.S.'s (4/5) class, students worked in groups of four to explore and record their observations of Oobleck, a substance that has properties of both liquids and solids. In another (2/3) class, students were given instructions as to how to use their take-home Oobleck kits. We observed students in M.B.'s class viewing the television broadcast, generating hypotheses about the questions posed in the program (as a class), and then working individually to create spaceships that could land successfully on an ocean of Oobleck and take off again without getting stuck.

Teachers are provided with calendars for each arc so they can anticipate television broadcasts and fax invitations from the SNOOPS, and can plan for the Galaxy, FOSS, and GEMS activities provided. Galaxy has designed activities for teachers that relate directly to questions and concepts raised in the television broadcast and complement already existing activities designed by the Lawrence Hall of Science. For example in arc three, "Building Models to Explain and Invent Ideas," teachers are provided with a FOSS manual that describes activities students do in collaborative groups, outlines the science concepts and thinking processes, and suggests interdisciplinary activities. In one such activity students make multisensory observations of Black Boxes in order to determine what is inside them. They develop conceptual and then physical models to explain what is in the black boxes.

5.0 Technologies Involved [*types*]

Y	Microcomputers
Y	Word processing
N	ILS
N	Spreadsheet

N	Other LANs
N	Hypermedia
N	WANs
N	Animation
N	CD-ROM
N	Simulation
N	Interactive videodisc
Y	Videocams and editing equipment
+Y	Other: Satellite Broadcasting, Satellite Faxing, Fax Machines, Televisions, Audio conferencing

6.0 Overview of Tech Uses

Student Uses [*kiduse*]

- Tutorial **[*tutor*]**

  Instructional math games are used in M.B.'s classroom, but are not a component of the Galaxy program.

- Exploratory **[*explore*]**

  M.B. did not mention that he uses exploratory software. This type of technology does not play a role in the Galaxy program, but is used by students within the school's computer lab.

- Communication **[*commtn*]**

  Clearly, communication plays a key role in the Galaxy program. The main vehicle for communication is the fax machine, which carries the students' messages, or solutions, to a main hub and then relays the fax to the appropriate destination. The teachers' guide encourages cross-classroom sharing of ideas, observations and solutions to problems and the students have pen pals in other schools across the country with whom they communicate. During the broadcast students are invited to fax the television characters or students in their partner school to compare hypotheses and conclusions. M.B. has his students write to their pen pals to talk about an activity they did or what they learned. He claims that students have the opportunity to "do lots of different kinds of writing" because "it's all writing a letter, but within that letter may be a report about something [they did as an activity]." M.B. later elaborated that students write for personal communication, as well as writing research reports, project descriptions, expository texts, and engaging in creative writing. Within Project Galaxy, most writing (regardless of purpose or genre) is put into a letter format, then faxed to central headquarters and to partner schools.

The advantage to fax machines is that students can send their drawings and preliterate students (in the K-5 program) can still communicate their ideas. However, Galaxy's future plan is to have students linked through an electronic mail network, due to the many technical difficulties they have experienced with satellite faxing.

The "hoot 'n holler" is an audioconferencing telephone in the classroom for teachers or students to communicate in person with other classrooms. M.B. has found it difficult to be creative around this technology and none of the teachers reported frequent use of it.

- Tool [***tool***]
  The computer is used as a writing tool across the curriculum. While students in M.B.'s class usually compose at their desks, each has an assigned time to enter and revise at the computer.

Teacher Uses [*tchuse*]

- Communication
  Communication between classrooms has primarily been between students. Teachers have found the "hoot 'n holler" audioconferencing telephone difficult to use. Occasionally, teachers have communicated via the fax with other teachers in partner schools (in Florida, Massachusetts, and New York).

- Presentation
  The Galaxy satellite broadcasts are an example of using technology for presentations.

  Instructional Management
  M.B. did not discuss the use of technology for instructional management.

- Training

  M.B. volunteered to facilitate a six-session teacher training program that is broadcast to Galaxy schools. The focus of the program is cooperative learning. Groups of teachers gather every two weeks to watch a 20-minute broadcast of a Galaxy teacher working in his or her classroom with groups of students. At various moments throughout the broadcast, the action is stopped and teachers on screen discuss what is happening in the classroom. The broadcasts do not have specific themes, but bring up a variety of issues related to cooperative learning. After this viewing teachers at individual school sites discuss their thoughts and reactions.

  Five or six teachers have participated in this teacher training program at Nathaniel; only two or three are regulars and M.B. has been the only Galaxy teacher acting as a facilitator. M.B.'s role is to make sure the meeting happens and to facilitate discussion. He feels that the programs are good for sparking discussion because they provide a real context to discuss issues related to cooperative learning. One such discussion centered around how to form student groups. He believes that the sessions build on the Galaxy program and are especially good for teachers who have not yet facilitated cooperative learning in their classrooms. M.B. himself has learned that he can incorporate cooperative learning into anything. He now has his students work in groups ninety percent of the time, compared to seventy-five percent previously (outside of regular reading groups).

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration

  Yes. Collaborative learning is a general goal for all the Galaxy curricula. In the science program students experiment, hypothesize and come to solutions in groups. The guides to FOSS activities suggest collaborative groups of four or teams of two in which students take turns assuming certain responsibilities (e.g. the reader/reporter, the recorder, the getter, the starter).

  M.B.'s classroom is organized so that desks are grouped in fours, and a setting for peer communication is always in place. According to M.B., *"In terms of the overall project I'd say I'm just there to facilitate... in terms of the science curriculum... I definitely have to teach some things and get them started, and then it's just their exploring and discovering on their own, I mean, it's really hands on and I do all of* *them in collaborative groups... I just get them started and let them explore on their own... and push for different ideas and perspectives."*

- Independent exploration

  Yes. According to M.B. "They do all of it collaboratively, but sometimes then the kids go 'Well, I'm doing it on my own because I have another idea, too'... so they split off a little." M.B. says in these cases the dissenting students fax their ideas in addition to their groups' ideas. This example illustrates how M.B. encourages independent exploration in a group-oriented program. The exercise observed in his class, where the students were drawing their individual spaceships, is evidence that every activity need not be carried out in a group format.

  The take-home kits Galaxy provides for each student allows individuals to continue exploring concepts and skills they have learned in the classroom on their own time with family members.

- Access to outside information resources

  Yes. In the television program and the activity guide students are frequently prompted to communicate and share ideas with students in other schools via fax. M.B. himself encourages his students to communicate with their pen pals about the work they are doing.

- Support for higher-level thinking

  M.B. did not discuss this benefit of technology use. However the Galaxy curriculum engages students in a form of scientific inquiry which includes problem-solving, hypothesis-testing, data analysis and synthesis, making predictions, and drawing conclusions.

- Creativity

  Yes. The open-ended nature of Galaxy activities leaves room for multiple creative responses. Students are asked to pose their own questions, test their own hypotheses, create models that solve problems, and write or draw faxes that communicate their findings.

- Technology skills

  M.B. speaks about "getting students to be familiar with technology," but does not mention specific skills. None of the three Galaxy teachers we spoke with have their students fax their own work; they send their faxes for them.

8.0 Realized Benefits of Technology [*kidout*]

- Motivation [***motiv***]

  Clearly student motivation is one of the most significant benefits of the Galaxy program. All of the teachers we talked to mentioned how much their students were engaged by the television broadcasts. During our observation of M.B.'s classroom the students sang along with the theme song to the show and asked to watch it again when it was over. According to the Galaxy project coordinator "They all love the video, they didn't want it to end." M.B. tells us "They've been very excited about it--they love watching the show, they love writing about it, they love doing the experiments." Keana, one of M.B.'s students told us that before she wasn't interested in science then "[her] mind just flipped onto SNOOPS." M.B. echoes this sentiment: "Those kids who didn't think science was fun now know science is fun."

  The authentic nature of the activities students are asked to do contributes to their interest and engagement. According to M.B. *"For me, besides actually getting the students familiar with technology, the big thing with Galaxy is the motivation--there's a real reason for them to do those science experiments, there's a real reason for them to write about what they have found and to fax it off."* The on-site coordinator for Galaxy, told us that the students were excited about Galaxy because they were the ones solving the mysteries for the characters on the show.

  All three teachers mentioned that their students were more motivated to write as a result of Galaxy. The opportunity to have a fax on the air, or printed in the Galaxy magazine, or responded to by a student in another state, are all motivating factors. M.B.: *"I use writing a lot to have them process what they've just done, you know in all areas--math, science, everything--and I think it would be much more difficult to ask them to write if they were just writing in a journal or something for themselves or for me, but when I can say 'Okay, now I'd like you to respond to your pen pal about this activity we just did... Think about what you learned or how you did the* *project'... then they are going to write more and they're going to be more interested and it's going to mean something. And so it's a real life response."*

- Attendance, time on task, discipline **[*kidbehav*]**
  None of the Galaxy teachers interviewed mentioned the effect of Galaxy on attendance, time on task, or discipline. Observations were not sufficient to draw any conclusions.

- Amount of collaboration and cooperative learning skills **[*cooplg*]**
  Yes. M.B. has learned that he can incorporate cooperative learning into anything. He reports that previously he used cooperative groups 75% of the time (outside of regular reading groups), but now he uses them 90% of the time.

- Ability to manage own learning **[*selfreg*]**
  None of the Galaxy teachers interviewed mentioned students' ability to manage their own learning. Observations were not sufficient to draw any conclusions.

- Access to outside information resources **[*outinfo*]**
  Yes. Student can access outside information sources through the fax (linked by satellite) or the audioconferencing telephone. The fax machine is used more often than the telephone. Students are encouraged by their teachers and the kids on the television broadcast to share their ideas with students and learn from students all over the country. The project coordinator claims that Galaxy has broadened these students' world; they have their own "information highway" and can learn about what it's like to live in different parts of the continent.

- Support for higher-level thinking **[*higher*]**
  Yes. M.B. did not discuss this benefit of technology use. However the Galaxy curriculum engages students in a form of scientific inquiry which includes problem-solving, hypothesis-testing, data analysis and synthesis, making predictions, and drawing conclusions. Many of these activities were in evidence during an observed student discussion, led by M.B. following a Galaxy episode. Students were actively engaged in analyzing the events of the episode in order to develop their own hypotheses and predications. M.B. was adept at guiding the discussion in a direction that would lead students to further their thinking and critical analysis.

- Complexity of tasks students can accomplish **[*taskacc*]**

  M.B. did not discuss this benefit of technology use.

- Learning on specific tasks **[*kidlearn*]**

  Yes. According to M.B. "I think there's been a big improvement in their writing as they try and explore their ideas and put them down better--they send their writing off to the SNOOPS... It makes them strive to write better because they are writing for a purpose."

  In their evaluation of the first phase of Galaxy (the language arts program) Far West Laboratory (FWL) reports that Galaxy students made significant gains in reading comprehension and vocabulary. FWL is currently scoring science performance assessments that measure the following skills: classification, chart reading, prediction, observation and description, drawing conclusions, forming hypothesis using observations as evidence.

- Creativity **[*create*]**

  Yes. The open-ended nature of Galaxy activities leaves room for multiple creative responses. Students are asked to test their own hypotheses, pose their own questions, create models that solve problems, and write or draw faxes. We observed students creating spaceships that could land successfully on an ocean of Oobleck and then take off again without getting stuck.

- Greater attention to how a product will be understood by others **[*audience*]**

  Yes. M.B. encourages his students to write to their pen pals and tell them about what they are learning. M.B. thinks that writing for an authentic audience improves his students' skills.

- Technology skills **[*hackskl*]**

  M.B. speaks about "getting students to be familiar with technology," but does not mention specific skills. None of the three Galaxy teachers we spoke with have their students fax their own work; they send their faxes for them. Technology use within the project consists primarily of word processing, and the observation of the use of VCR and fax machines (rather than direct use on the part of students) as learning and communication tools.

- Implementation Obstacles

  All three teachers mentioned problems with the fax machine breaking down, with Nathaniel's year-round school schedule interfering with television broadcasts, and with the time it takes for teachers to put together the take-home kits. These problems were frustrating for both students and teachers; more than one teacher mentioned how the fax break-downs negatively affected student motivation.

PROGRESSIVE SCHOOL DEBRIEFING

Site: The Progressive School

Principal: B. B.

1.0 Summary [*sum*]

From the beginning the Progressive School stressed many of the concepts advocated in the recent education reform literature--active learning, thematic instruction, multiage groupings. The school's multidisciplinary "spiral curriculum" centers around the central theme of "man's survival in the environment". Five multiage clusters each take a different slice within this central theme, combining different disciplines such as science and literature in building concepts. The schedule was designed to be very flexible with the school day divided roughly into four long instructional blocks.

Although there was limited use of technology (Apple IIs) in some classrooms from the early 80s, the serious use of technology began in 1986 when A. K. selected the school as a testbed for his human-computer interface research. A. K. originally wanted to use one or two classrooms, but the school principal insisted that technology be introduced on a whole-school basis so that it would unite the school rather than fragment it. A. K. and the school staff shared the idea that technology should be introduced in such a way that it would be easily accessible as a tool but neither the focus of instruction nor an intrusive part of the classroom environment. Classrooms now have an average of one computer for every two students plus VCR, laser disc, CD-ROM, and telecommunications connections.

2.0 Context and Reform Overview

2.1 Educational Context. *[context]*

Setting. The Progressive School is housed in a permanent administrative building and a series of temporary buildings squeezed onto the campus of another elementary school. The school is located in a heavily urban area of the Western City, near the juncture of two freeways. The physical facility is not impressive from the outside, but from the inside there is a kind of good-natured cheerfulness, with lots of student artwork and other artifacts. The temporary buildings are long "box-car" style rectangles (double trailers), each housing a cluster of 64 students and two teachers. Although the administrative building looks its age, it does house a multimedia room and sound studio that have been renovated and contain up-to-date computer and video equipment.

Grade levels. This magnet school serves 384 students ages 6 to 12 in multiage clusters, each encompassing 2-3 years. The clusters overlap each other, and some students stay in a given cluster for more than one year. The staff try to give all students the experience of being both the oldest and the youngest at some time during their Progressive School career. A kindergarten class was added in 1993-94.

2.2 Demographic Information [*demo*]

Applicable unit: School Class Project District Other
Number of certified teachers (FTE): 12 & magnet coordinator & 4 part-time
Enrollment as of 9/93: 384
Number or percent free or reduced lunch: 23%
Number or percent LEP or NEP: 11%
Number or percent special education: 5%
Ethnic Composition *(Number or percent in each category)*

23%	20%	39.5%
African American	Hispanic	Caucasian, Non-Hispanic
.1%	17.4%	0%
Native American	Asian/Pacific Islander	Other

Estimated percent students w/ computers in home: 32%

2.3 Education Indicators [*stats*]

Historically the school has had 500-600 applicants per year for the 50-60 slots for new children at this magnet school. After getting extensive publicity for becoming one of state's first charter schools in the spring of 1993, Progressive received over 800 applications for the 1994-95 school year. The school has traditionally shown good test scores, especially given the economic diversity of its student population. Parents are enthusiastic supporters; many volunteer time and donate money. Since B. B. became principal, there has been very low turnover among teachers. (In the last eight years, only two have left because they didn't like the environment, and two others have retired.)

2.4 Reform History [*reform*].

- Nature and when started [***history***]

The Progressive School was started in 1977 by a group of parents and teachers who wanted an alternative to the "back-to-basics" approach that dominated the Western City Unified School District (W.C.U.S.D.) at that time. The group wanted to start a school based upon the principles of Jerome Bruner and the practices of the British infant schools. Their desire coincided with the decision of the W.C.U.S.D. to set up a series of magnet schools in order to comply with court-ordered desegregation. The students are selected at random within a set of geographic and ethnic strata.

From the beginning the school stressed many of the concepts now popular in education reform literature—active learning, thematic instruction, multiage groupings. The school's multidisciplinary "spiral curriculum" centers around the central theme of "man's survival in the environment". The different clusters each take a different slice within this central theme, combining different disciplines such as science and literature in building concepts. The themes evolve but do not change drastically from year to year. Teachers do vary their angle on the theme, however, so that students who stay in the cluster for more than one year do not get bored. In 1992-93 the cluster themes were (from youngest to oldest) "My Own World", "People Can Get Along", "The City Environment", "Oceanography" and the "Civil War/Civil Rights", and "Life on Earth and Humans' Place in It".

The Progressive School had a history of getting waivers from the district for its curriculum and methodology. Rather than continue to get waivers on a piecemeal basis, the school chose to apply to the state for Charter School status and received it in March of 1993. As a charter school, Progressive will have a mandate to experiment and to work with the education research community. The school is not breaking away from the district (and in fact the district helped draft the charter school petition) but will have the district continue to take responsibility for things like liability, physical plant, and supplies while the staff concentrate on their internal organization and teaching. They have selected a set of student outcomes on which to be judged and will be working with key staff members at the University's School of Education on developing performance-based assessments.

- Reform Features **[*feature*]** *(circle all that apply)*

X Nongraded groupings
X Teacher professionalization
X Extended periods
X Authentic assessment
X Schoolwide themes
X Use of outside resources

- Key Individuals **[*key*]**

The school has a very strong set of teachers (several of whom are highlighted in the classroom descriptions that follow) but the overall tone and energy for the place stem from the principal, **B. B.** She became principal in 1981 when she was selected by the parents and teachers. B. B. impressed us as very involved in teaching and learning issues, dedicated, energetic, and a consummate politician. She really puts everything she has into making the school a success and inspires others with her fervor. One district administrator described her as "outstanding", "a diplomat", and a "tough cookie". During the 1993-94 school year, B. B. announced that it would be her last. She felt that this was a hard decision but the time was right for her and the school was in very good shape to carry on. She notes that as long as she was principal, she would be a focal point and there wouldn't be a real test of site-based management. *"It's like a mother when you know when the right time is to let go of it; where the teachers have the strength and everything you put in place. The organizational structure has to stand on it's own, and the process has to take place."*

- Funding sources for reform **[*funds*]**

In addition to regular allocations for education, the Progressive School has received desegregation funds and major contributions of equipment and staff support from Apple Computer, which are described in the section on funding for technology. During 1993-94, after Apple support was cut, the parents' fund raising letter estimated that the cost per student for the "extras" (including not only technology but music, art, field trips, and so on) is $350 per student a year. (Last year's head of the parent committee indicated that some of the more financially able parents are willing to donate something approximating the equivalent of a private school tuition because without the Progressive School that would be their only alternative.)

- District involvement/support [*localref*]

The Progressive School has always had its own educational philosophy, quite distinct from that of the district. Nevertheless, the district has given the school waivers and permission to be different. Progressive applied for and became one of the state's first charter schools in March of 1993. The district was friendly towards the school's effort to petition for charter status; under this plan, the district will continue to handle areas such as insurance, physical plant, and supplies, but the school will have autonomy with respect to hiring of teachers, organization, and teaching. During its first year as a charter school, Progressive was able to leverage its charter school status to get the district to approve its choice for its new kindergarten teacher even though she had only a provisional credential and the district was not otherwise hiring those with provisional credentials. The school was also applying for permission to spend some of the money earmarked for textbooks on technology and duplication of materials for instruction. The charter school status was a major part of the argument for this kind of waiver (which the school board subsequently approved).

- State/federal involvement/support [*stateref*]

The state charter schools bill gives the Progressive School blanket waivers for some requirements (such as the education code for class size, school calendar, use of money, and personnel strategies) and a mandate to experiment with innovative practices and work with the research community in exchange for accountability. In preparation for the charter petition, the school developed a set of student outcomes on which they wish to be held accountable and initiated discussions with one of the staff members at the University's School of Education concerning how they might move to performance-based assessment.

- Role of tech in reform efforts [*techre*] *(classify and describe)*:

X Part of initial reform concept X Emerging part of reform efforts Parallel effort

Technology was not a part of the original Progressive School concept, but as the school evolved, parents and staff developed a sense that it was important to look at technology and what it might add. In 1984 every teacher applied for and got a CTIP grant (which supplied computers to classrooms). They also received an SB803 grant to improve computer literacy. After A. K.

visited the school in 1985 and selected it for his research, there was a large influx of technology in 1986 (described further below). The school staff worked collaboratively with A. K. to make sure that the way the technology introduced was consistent with their instructional philosophy. This technology introduction brought with it opportunities for discussion about what the school was trying to accomplish and how technology related to it. Through these discussions, the staff decided that they did not want to use commercial instructional software; rather, they chose to use applications software that would allow students to create with technology. Involvement with A. K. and Apple also provided the school with access to outside research and curriculum experts (e.g., D. N.), paid consultantships for teachers, and opportunities to attend national and international conferences.

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*] *(what expected to accomplish)*

A. K. was interested in investigating how children use technology to learn (as opposed to trying to raise test scores) and in understanding what kind of interface and "machine smarts" would be needed to allow even young children to do sophisticated problem solving. A. K.'s conviction was that if you design something so well that young children can accomplish difficult tasks with ease, it will be very effective for adults as well.

From the school's perspective, the teachers were interested in technology's potential for supporting student thinking. More specifically, they foresaw benefits in terms of providing "the missing steps between a totally physical, multi-sensory environment and the textbook environment by providing a two dimensional manipulative process" (B. B., "Reflections After Five Years of Using Computers at the [Progressive School]", p. 4). Given the school's emphasis on hands-on activities, technology could be used to "create mental bridges between hands-on knowledge and symbolic knowledge" (ibid.) The teachers' software choices and use of technology (i.e., their emphasis on software applications over instructional software) suggests further that the teachers wanted to give students tools that would help them create things rather than giving them more facts or raising their test scores.

3.2 When & How Application Started [*how*]

Although there was limited use of computers in some classrooms from the school's early days, the serious introduction of technology began in 1986 after A. K., an innovator in human-computer interface design, selected the school as the site for his research project . A. K. wanted to use the school as a testbed for ideas about new ways to interact with intelligent software. His notion was that if you design something powerful yet simple enough for kids, it will be good for adults as well. To have an appropriate testbed, there had to be enough technology around so that access was not an issue.

A. K. originally proposed to use one or two classrooms for his research. The Progressive School's principal, however, objected to the first plan despite the offer of a classroom full of computers. It was her conviction that any introduction of technology had to be done on a whole-school basis, so that it would be something that united the school rather than fragmenting it. In the first year, the school tried a computer lab, but then the teachers voted against it because this arrangement separated students from their regular classroom teachers. The lab was discontinued and it was agreed that technology would be introduced into all of the clusters in such a way that it would be easily accessible as a tool but neither the focus of instruction nor an intrusive part of the classroom environment (A. K., 1991). Over time, Apple placed approximately 30 computers into each cluster classroom of 64 students. Most of the computers are recessed into specially designed tables that can be used for other kinds of student work when the computer is not needed.

Technology integration is at a mature stage in this school. Students use technology in every classroom and have become so accustomed to it that there is no novelty value. Apple provided the school with an extraordinary measure of support. In addition to the computers, CD-ROM and laser disc players, networking, and other technology, the corporation supported a full-time technical support person and a portion of the time of several other staff members who provided assistance with technology activities through the end of the 1992-93 school year. During this six-year period, Apple also paid the school's teachers as consultants over the summer and winter breaks, during which time the teachers were able to receive coaching on technology use and spend time developing materials for use in their classrooms. During the 1993-

94 school year, Apple supplied $50,000 in funding and continued to support one technical support position. It also trained six teachers in computer maintenance. Apple has indicated the intention to donate $25,000 to the school for next year but will no longer supply an on-site technical staff person. The company would like to maintain an affiliation with the school but wants to get out of the role of being a major financial support.

3.3 Technologies Used *[types] (give numbers for hardware)*

X • Microcomputers
• ILS
X • Other LANs
X • WANs
X • CD-ROM (in each cluster)
X • Interactive videodisc (7 laser disc players)
X • Videocams and editing equipment - 6
X • Word processing
X • Spreadsheet
X • Hypermedia
X • Animation
X • Simulation
• Other

3.4 Target Grades & Curricula [*levels, curric*]

Technology is integrated into all clusters and content areas.

3.5 Key School Players *[Infield] (Provide names, titles, and a description of roles)*

D. M., the former technology coordinator funded by Apple, was important in providing on-site assistance with new software and help with technology problems as they arose. D. M. reported that one of the main things he liked about working with the Progressive School teachers is the fact *"that they are always working...I'll get calls at 11 PM and they are busy trying to develop a HyperCard stack for a new activity."* Conversely, what the teachers like about D. M. is that they can call him at 11 o'clock at night! The (all-female) teaching staff also found him very supportive and unintimidating. For his part, D. M. has great respect for the teachers and makes the point that he and the technology are in the background--the teachers are the stars. **B. B.,** the principal, was an important player not so much in what she did with technology per se but in being able to keep her eye on the main instructional issues while incorporating such a large, and potentially distracting, infusion of technology. Among the teachers, it is difficult to single out a few as technology leaders because so many of them make extensive use of technology.

3.6 Outside Players in Technology Application *[outfield] Discuss important players outside the school including:*

A. K. was clearly a key individual in selecting the Progressive School for this investment in technology and for conducting continued dialogues with the teachers for a period of over six years.

- District involvement ***[distr]***

  The district has not supplied technology or technical assistance but it did give the school the power to run the technology and supplied the right conduits. The district administrator interviewed said that W.C.U.S.D. does not provide schools with guidance regarding technology purchases. He also stated that the district has "no handle on maintenance". The district provides very limited technical assistance to some schools. With all its support from Apple, the Progressive School did not have to rely on the district for these functions.

- State/federal involvement ***[state]***

  The state provided limited support through the CTIP and SB 803 grants, which supported acquisition of computers and computer literacy activities. Although not directly related to technology use, the state's charter school program is important in providing a mandate for the school to continue to experiment and retain its unique character. In 1993-94 Progressive received a $19,000 innovative program grant under Chapter 2 for telecommunications. The school has obtained a high-speed frame relay service and gopher applications software.

- Business involvement ***[bus]***

  Apple Computer has had a major impact on the school in terms of technology use and support for teacher's acquisition of facility with technology. Beginning in 1986, Apple introduced large numbers of microcomputers into classrooms, eventually totaling around 30 computers for each cluster classroom of 64 students. Most of the computers were recessed into specially designed tables that can be used for other kinds of student work when the computer is not needed. In addition to the computers, Apple provided CD-ROM and laser disc players, digital scanners, VCRs, LANs, phone lines and modems, AppleLink addresses, and other technology, as well as a soundproof studio in the administration building. (Part of A. K.'s original Project concept was to have a 10' X 10' underwater scene on a large-projection screen with specially designed input devices that students could strap themselves into and take the role of different organisms in the underwater environment.)

Apple also provided an extensive human support structure for technology use at Progressive. The corporation supported a full-time technical support person and a portion of the time of several other staff members who provided assistance with technology activities through the end of the 1992-93 school year. During this six-year period, Apple also paid the school's teachers as consultants over the summer and winter breaks, during which time the teachers were able to receive coaching on technology use and spend time developing materials for use in their classrooms. (This practice ended after the 1992-93 school year.) During the 1993-94 school year, Apple supplied $50,000 in funding (which covered the $37,000 annual maintenance costs for the equipment plus some other expenditures) and continued to support one technical support position. It also trained six teachers in computer maintenance. Apple has indicated the intention to donate $25,000 to the school for next year but will no longer supply an on-site technical staff person. The company would like to maintain an affiliation with the school but wants to get out of the role of being a major financial support. Concerning the experience with Apple, the principal reflects, *"I have to think of it as seven years of a fabulous education from Apple where we didn't have to pay to go to graduate school, but they paid us to go. I can't look at the fact that they walked away and say they left us...they gave us...far more than we ever anticipated going into this project. Far more than the five years that they said that the project would last. We became very dependent and it is not a bad thing that we have to walk away from this and handle this ourselves. It's good for us."*

- Foundation involvement ***[foundtn]***

  The Progressive School did not receive foundation funding for its original technology implementation. In 1993-94, with the cutback in Apple's support, the teachers became more active in seeking foundation funds. They received a grant from a private foundation to develop an environmental unit around building a garden. The Education Partnership funded a project to do robotics LegoLOGO. A problem that B. B. brings up is the fact that foundations are interested in funding new things (e.g., a new garden). It is very difficult to get support for the maintenance of existing programs (e.g., the garden the school already had).

- Parent involvement ***[parent]***

  The Progressive School was originally founded by parents as well as teachers and there has been a strong tradition of parent involvement. Any classroom the visitor enters is as likely as not to have a parent volunteer present. "Veteran" parents take responsibility for holding evening coffees in various parts of the city to bring new parents into the fold and make sure they understand the philosophy of the school. Parents raise additional funds for the school. A Parents' Advisory Council consists of 12 parent representatives, 4 parents from each geographic zone (the Progressive School serves kids from all over the Western City's area). In combination with teachers, this council makes decisions about staff selection, curriculum, staff development, and program evaluation. Each teacher team receives an evaluation (anonymous) from the parent committee and is expected to answer issues raised by the parents. The chairman of the Advisory Committee reported that there is a core group of about 100 active parents (a high number for a school of just 385 students). Parents volunteer time, raise money, and pledge to support education by providing appropriate time and place to study at home. The school has been very successful in getting high involvement with middle-class parents, less so with low-SES parents (who have a harder time making meetings which are sometimes far from their homes) and especially Latino parents. The school is making a great effort to improve minority parent involvement (e.g., having a bilingual parent call and pick up a Spanish monolingual parent for meetings.) The chairman of the Advisory Committee says that the parents have a very high regard for Progressive School teachers. They appreciate the incredible amount of time that these teachers put in and the individualized attention they provide. (e.g., during 1992-93, teachers in the W.C.U.S.D. were forced to take a 10% pay cut and the teachers' union instructed teachers not to do anything extra. The Progressive School teachers continued to do all the things--including all the night meetings--they ever did.)

With the reduced support from Apple in 1993-94, parents' involvement has focused more on budget and fundraising issues. They have gotten very active in trying to raise additional funds and to help the school plan strategies that will maintain its programs.

- Other outside influences, including research

4.0 Overview of Tech Uses

4.1 Student Uses [kiduse]. *Describe main ways in which students are using technology and classify uses as follows:*

Tutorial ***[tutor]***

We did not observe tutorial software being used. This technology use does not appear well matched to the particular goals and the constructivist philosophy that underlie the educational program at Progressive School.

Exploratory ***[explore]***

Yes. Students make exploratory use of software in connection with research projects and other classroom activities. In the Yellow Cluster, for example, students use *Sim City*. Rather than acting out the simulation as specified within the software program, however, Yellow Cluster has adapted its use for their own purposes. The software is used to provide feedback regarding problems related to the students' initial city plans (e.g., pollution, not enough transportation).

Communication ***[commtn]***

Yes. Students at the Progressive School have participated for a number of years in the Apple Global Education network. They send messages (essays, jokes) to students all over the world. They have also participated in a number of joint, network-supported activities with other schools. During 1994, the school got a grant to put in an Internet connection through a state university network, and a number of teachers are planning on getting training on Internet use over the summer. They are starting to develop plans for incorporating Internet activities into their curricula. For example, in the Yellow Cluster's City Building Project, students will be linked to the state's Museum of Photography, giving them access to photography archives that will be used within their research on the history of the city.

Tool ***[tool]***

Yes. The primary use of the computer within the school is as a tool. Students make frequent use of word processing software (MacWrite) and drawing programs (e.g., Canvas) from the earliest grades. One teacher has developed software in HyperCard that allows young students to draw a picture on the computer, compose a description of it, and then come to her for a conference in which they convert the child's writing to standard English. (The final product incorporates all three pieces.) Students also use spreadsheet and animation software for various projects.

- Teacher Uses **[*tchuse*]**

  Communication

  Teachers communicate with teachers in other Apple-supported classrooms and schools, as well as with personnel from within the company, via AppleLink. In addition to providing another vehicle for technical support, their participation over the network has given them the opportunity to learn from the implementation stories of others.

  Presentation

  Teachers use software tools to produce curriculum materials for their classes. Several of the teachers noted that the software allows them to tailor material for particular small groups of students, covering the same concepts with all groups but adapting the examples to fit the particular area the group has been studying.

  Instructional Management

  Teachers did not mention the use of technology for grading or monitoring student progress. However, the work created by students on the computer provides them with an ongoing record of a student's activities.

5.0 Implementation Details

5.1 Problems Encountered [probs]. *Describe problem areas including any of the following that were issues according to teachers, tech coordinator, or administrators.*

- Difficulties in selecting hardware/software **[*pick*]**

  Teachers did not cite difficulties in this area.

- Difficulties obtaining hardware/software **[*get*]**

  The school has had an unusual level of support in this area from Apple Computer. The problem they are faced with is obsolescence of their older computers.

- Difficulties maintaining systems **[*work*]**

  For six years, Apple both handled the maintenance and picked up the tab. When Apple cut back its support in 1993-94, the school was surprised to find out that the annual maintenance bill on its equipment was $37,000. The school had not dealt with this problem previously and did not know of any budget where this very significant item would fit. The principal reflects: *"I think schools have to know when they are going into technology that there is a cost beyond the buying of equipment, that industry understands. Industry builds in that cost; they build in obsolescence; they build in upgrading; they build in repair. But schools think they have a one time expense and that has to be part of the puzzle and part of the formula that you build into it..."*

- Theft/vandalism **[*crime*]**

  Not a problem.

- Teacher lack of knowledge/fear **[*block*]**

  This problem was overcome. Many of the teachers began with little technology knowledge but they have had excellent support both from D. M., Apple's on-site technology coordinator, and from each other.

- Lack of time for learning to use technology or developing technology-related curriculum units ***[notime]***

  In part this issue was addressed through the provision of support from Apple for teachers to work on their technology skills and the development of technology-related units during the two school breaks in Progressive's year-round schedule. The other way in which this problem gets overcome is the teachers' willingness to put their own time into such activities. However, there is never enough time to do all that the teachers would like to do.

- Disappointing results from using technology **[*letdown*]**
  Not a problem.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**
  Not a problem.

- Lack of funds **[*nofunds*]**
  Not a problem prior to 1994 because of Apple's donations. The principal realizes that their situation was very unusual: *"We were saying seven years ago when we started that in five years time the costs are going to be so far down that these machines are going to be available to everybody and everyone will have accessibility...well costs have come down tremendously but you are still not seeing that kind of universal use. They haven't come down sufficiently for schools to really go into technology in the way that they want to. I was just at a technology conference seminar...looking at different schools that have heavily gone into technology...what had happened so far and where do we want to go...I think all of us are saying the same things...we did not expect the cost factor to still be a problem seven years down the line."* The school is now concerned with the cost of maintaining and upgrading their systems (which are now as much as seven years old). Another cost that had not been appreciated in the past was that of telecommunications charges. The school wants to get more involved in using Internet resources, but has concern about getting the phone bills paid.

- Resentment from nonparticipating classes/schools **[*green*]**
  The Progressive School shares a campus with a regular neighborhood school (Craven Hills). At the time of our visit, a number of Craven Hills parents attended a joint meeting and expressed anger over the fact that the Progressive School had so much more technology than their own school. The principal took this problem seriously and was quick to respond by setting up a meeting that Craven Hills parents could attend and starting to think about ways that Craven Hills students could get some access to Progressive School technology.

- Lack of technical support **[*nohack*]**

  Not a problem in the past because of on-site support funded by Apple. With only one person on site in 1993-94, the teachers had to take over many of these functions. Although this was an additional burden on the teachers, they reportedly coped quite well.

- Failure to see fast positive effects on test scores **[*noshow*]**

  Not a problem.

- Other **[*bug*]**

  One of the biggest on-going barriers to the Progressive School's instructional activities with or without computers is the district-mandated student:teacher ratio of 34:1. The use of parent aides mitigates this problem somewhat, but management of a class this size is always a challenge. As one teachers expressed it, *"When 1/4 of the kids are taken out [for some special activity], this place really hums."*

5.2 Strategies for Overcoming Barriers *[solve]*. *Describe the steps taken to deal with the problems. Include any of the following:*

- Inservice training/release time

  This issue was addressed through the provision of support from Apple for teachers to work on their technology skills and the development of technology-related units during the two school breaks in Progressive's year-round schedule. The other way in which this problem gets overcome is the teachers' willingness to put their own time into such activities.

- Involvement of outside experts

  The school benefited from extensive contact with A. K. and his ideas about how technology can support and stimulate student thinking as well as from other experts brought in by A. K. and funded by Apple (e.g., D. N. whose city building curriculum became the focus of one cluster's curriculum).

- Creative fund raising

  The school has been very successful in obtaining support from Apple. The parents' Friends of the Progressive School Group has helped also and stepped up its efforts in 1993-94 when Apple funding was cut. In that year the school obtained a $19,000 innovative program grant from Chapter 2 and also obtained several smaller grants for specific activities.

- Other

5.3 Facilitators ***[facil]*** *Describe factors that helped this project, including:*

- Technical support on hardware/software ***[techta]***
  D. M. was funded by Apple to play a kind of on-site technology coordinator role. In addition, there was another technology assistant who worked with D. M. part time and also a telecommunication coordinator who was funded partially by Apple and partially by the PTA to work with students and teachers on telecommunications projects.

- Teaching skills (nontechnology) ***[haveskl]***
  Teachers reported that the incorporation of a handful of computers was easy because students are used to working on different things and in small groups.

- Technical assistance on integrating technology into instruction ***[instrta]***
  None of the technology support people at Progressive saw their job as attending to hardware/software questions only. There was always an emphasis on helping teachers integrate the technology with their instructional goals.

- Supported time for teachers to develop skills ***[timesupp]***
  This issue was addressed through the provision of support from Apple for teachers to work on their technology skills and the development of technology-related units during the two school breaks in Progressive's year-round schedule. The other way in which this problem gets overcome is the teachers' willingness to put their own time into such activities.

- Other

5.4 Costs [costs] *(Estimates in dollars or person months)*

The parents' fund raising letter estimated that the additional activities at the Progressive school beyond the basics funded by the district cost $350 per child per year, but this figure is not all-inclusive. The computer maintenance activities for 1993-94 were $37,000 and are something that the principal emphasizes must be considered in planning technology projects *"I think schools have to know when they are going into technology that there is a cost beyond the buying of equipment, that industry understands. Industry builds in that cost; they build in obsolescence; they build in upgrading; they build in repair. But schools think they have a one time expense and that has to be part of the puzzle and part of the formula that you build into it..."* Teacher training is another important cost category (Apple supported most of the training requirements for the Progressive School).

6.0 **Impacts** ***[Impact]*** *(Record objective and subjective reports from administrators, teachers, students, and parents.)*

6.1 **Effects on Students [*kidout*].** *Include areas such as:*

- Motivation **[motiv]**

  Many teachers mentioned the effect of technology on student motivation. One staff member reported that the introduction of technology got kids who had never participated before in class discussions to become active participants.

- Self esteem **[kidestm]**

  Self esteem was one of the biggest positive impacts cited by teachers. One team talked about technology giving kids a "sense of power" and "fearlessness". Another team talked about students developing confidence and pride in the fact that they could do things on computers that their parents couldn't do.

- Attendance, retention, disciplinary rates **[kidbehav]**

  The Progressive School has a good record in these areas, but the principal warns that you can't single out technology as the causal factor. The many elements that contribute to the school's supportive climate and sense of community are impossible to disentangle.

- Technology skills **[hackskl]**

  Within most activities, technology skills were an enabler rather than an end in themselves. However, several of the teachers were interested in the issue of what technology skills their students should have and animation was an explicit part of one cluster curriculum. Students certainly showed skill in using Macintosh word processing, hypertext, and graphic software programs and appeared intrepid in approaching new technology tasks (e.g., a lesson in animation).

- Other

A number of teachers reported the belief that technology helps a wider diversity of kids excel ("those who don't succeed elsewhere can become stars"). One anecdote concerned a boy from a low-income family who was typically withdrawn in class but was the first to figure out how to use the computer to make music. When he played music on speakers attached to the teacher's computer, he stopped the room.

Several teachers reported that technology had affected their students' writing, producing a much greater willingness to do editing and revisions. One teacher also cited a greater inclination to do advance planning. Another noted that seeing their writing in print helped some students spot mechanical errors more readily. Another advantage was seen for those students who had trouble with the fine motor skills needed for writing.

One teacher did note that some kids don't think as well if they start their writing at a computer. She said that these students tend to play with the fonts and worry about typing rather than concentrating on the content.

Technology was cited by one staff member as creating an occasion for dialogue between students who wouldn't converse otherwise. In a school with such a diverse student body, this feature is important.

6.2 Effects on Teachers [*tchout*]. *Include areas such as:*

- Inclination to assign complex tasks ***[hardtask]***

Several teachers said that the availability of technology had led them to think about more complex projects. For example, one class does a six-week project, producing calendars with graphics and pieces of information or special anniversaries noted for almost every day of the month. Next year the calendars will be sold to raise money for attendance at an Outdoor School. The teachers said that they would not have thought of this project without the technology. Another staff member noted that technology made teachers see "new learning possibilities for their students."

- New instructional strategies ***[tchstrat]***
  For the most part, the kind of student-centered, project-based activities Progressive School teachers used technology for were already the mainstay of their teaching before the introduction of technology. However, one team did note that technology made it easier for them to adapt their lessons and integrate what students had just done into the next lesson. For example, the team had an existing unit on finding facts which they tailored for each of eight city-building commissions, taking into account the specific activities of that commission that year.

- Self esteem and sense of professionalism ***[tchach]***
  Within the Progressive School community, there is a strong sense of professionalism among the faculty. This is manifested in the level of involvement and expertise on the part of teachers, as well as in their ongoing commitment to professional growth activities. One of the most noted features of Apple's involvement at the school was their treatment of teachers as respected professionals. Teachers were paid by Apple as consultants and their ideas and input were highly valued. This experience meant a great deal to the teachers. They had a very different perception of the school district, which they blamed for low salaries and lack of interest in what teachers have to say.

- Communication with other teachers ***[tchtalk]***
  Yes. The principal noted, *"If we've gotten nothing else out of all of this [technology], it . . . gives teachers an invitation to share their ideas about instruction. This is something they're not expected to know already; it's not competitive."*

- Use of their time ***[timeuse]***
  Technology enables teachers to do some things more efficiently (e.g., generate their own curriculum materials or develop tailored tools such as that for capturing both corrected and uncorrected early writing), but it also takes time to maintain and time to plan for.

6.3 Effects on School Climate & Processes [*schouf*]

- Increased linkages with outside organizations, resources ***[link]***

  Technology brought a linkage to Apple and other schools involved in Apple-supported activities. Progressive staff attended both national and international conferences dealing with education and technology. Telecommunications will be used next year to provide access to resources at a nearby museum.

- Enhanced role as magnet ***[magnet]***

  The school has been a very attractive option within the city's public school system. There are always more applications than openings; in the last year there were over 800 for 50-60 spots. When asked what attracts parents to the Progressive School, principal B. B. responds: *"When parents come here, I never mention the word technology once; I talk about the methodology, the philosophy...I mean I wouldn't stand there and talk about encyclopedias, so why would I stand there and talk about technology?...But when they walk into the classrooms, they are blown away. Sure they want that for their children. Even if it's seven year old technology, it's seven years newer than anyone else has!"*

6.4 External Accountability Measures & Their Influence [*account*]

The Progressive School enjoys above-average test scores which look particularly good in light of the demographic diversity of their student body. The principal made a point of saying that she does not put much weight on standardized test scores and that they do not believe in letting these tests drive their curriculum. She did acknowledge, however, that the fact that their scores are above-average has given them the freedom to experiment without district interference. The district administrator interviewed also referred to the above-average test scores but noted that to him the more important measure of success is parent satisfaction. He noted that he had never known a parent to complain about the Progressive School.

6.5 Evaluation [*eval*]

At the time of our site visit, no formal evaluation had been conducted. Data are expected in the fall of 1994.

- Test scores

  The Progressive School's students reportedly have higher test scores than other students from the Western City's Westside even though their students are more diverse in terms of ethnicity and SES. *"Students in the bottom quarter of the class also score higher than their Westside counterparts"* according to a 1992 article in the city newspaper (D. L. Kirp, "Good Schools in Bad Times", January 5, 1992)

- Retention rates

  The school has a no retention policy.

- Attendance

  96%

- Discipline rates

- Teacher turnover

  Teacher turnover was described as low. In the past 8 years, 4 teachers have left.

7.0 Reflection and Advice

7.1 Dissemination [*spread*]

There was a plan to pair the Progressive School with a "buddy school" whose teachers would come to Progressive to increase their skills in instructional uses of technology. Nothing came of this plan, however. Teachers participate in conferences and have written articles for publications such as the CUE Newsletter. The school received extensive publicity after becoming a charter school. One of the classrooms was recently filmed by PBS.

7.2 Plans [*plans*]

Much of the school's planning energy has gone into figuring out how to replace retiring principal B. B. and how to cope with Apple's reduced involvement. While searching for a new principal, the school is grappling with issues such as how to maintain and upgrade its systems. B. B. remarks: *"Eventually we will have to sit down and weigh the $37,000 maintenance cost against buying new equipment. And it may be much more prudent financially to take pieces of that money and start replacing the technology because they are just going to keep going down. It's easier to start phasing in the new technology.. . .So split the $37,000 in half and spend $18,000 on new equipment and $18,000 on* *repair...and it may work out...they are going to have to do some studies and statistics on feasibility...where the major repairs are...(for example) if you buy ten new machines in Orange and Red [clusters], how much would that reduce repair? Then take the old machines and cannibalize them for repair. And there again, we keep saying 'My God, how did we get into this business?' We keep thinking that we are in the education business and we keep finding that we are in a management operations business. We were never trained to do these things."* They are aware of the need to find funding for their existing program.

In terms of new technology developments, the school is moving toward greater use of telecommunications. B. B. states *"I think that the technology for the future is going to be in telecommunications...the real answer is not going to be software, but getting into libraries, retrieval systems, data bases, communications between schools, parent communications. That's another piece that is going to be a very important piece, where parents are going to be able to get into schools and find out what homework is in and get tutorial help for their kids and find out a lot of things about the schools."* The school is involved in a state grant proposal along with another major city, a university elementary school, a state university, and Southwood Elementary schools to get a connection to the Internet; this connection would provide not just e-mail, but complete and full access, including two years of telephone costs.

7.3 Advice [*advice*]

The principal B. B. has written a very nice paper "Reflections After Five Years of Using Computers at the [Progressive School]". B. B. concludes with eight recommendations:

1. A strong involving curriculum has to be established and in place. Computers can support, enhance, and deepen the curriculum but do not substitute for it.
2. Teachers should have computers at home for exploration and practice.
3. Teachers need time and freedom to develop curricula that incorporate technology; they should feel safe in trying new things even at the risk of failure.
4. The school should provide on-going staff development and opportunities for sharing.
5. The school needs to provide technical support and maintenance.

6. Teachers need a minimum of three years to get comfortable with technology.
7. New performance and portfolio assessment procedures should be introduced.
8. Schools should wait five or six years before expecting to see evidence of the effectiveness of technology as a teaching and learning tool. (pp. 10-11).

In her 1994 interview, B. B. adds some points. Money could have been put aside from the very beginning for maintenance, accruing interest and developing so that when the machinery goes down, you have the funds and reserve that you have built into your budget . She also suggests having teachers trained from day one on maintenance and having them take care of their own computers, so that there is some sense of ownership and responsibility.

She would advise a school starting from scratch to start with kindergarten and add a grade or so each year. In this way, the school would not have to handle all of the expense or all of the teacher training requirement at once. Also, since the sixth grade would get technology last, they would have the newest, most powerful equipment.

She strongly recommends making sure that teachers have the technology to use at home. "*If they cannot afford to give their teachers a computer to work with at home, why should the teachers make that commitment? I think that was the one piece that made the teachers feel real professional; it made every teacher feel, "I am valued and I will buy into this. I cannot sit here with this computer on my desk at home and not do something about it. I can play with it all weekend...'* "

The district administrator advised that schools need flexibility and strong leadership.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: City Building Project

Teacher: D. P. and D. C.

Site: Progressive School

1.0 Summary [*sum*]

The City Building Project is a multidisciplinary, technology-supported project in which students design, build, and enact life within a "City of the Future." Students work on the project collaboratively in large and small groups (organized as neighborhood teams and city commissions). All aspects of the curriculum are integrated into the city building project, which lasts the duration of the school year. Technology is used as a tool to support a wide range of project activities. Students write reports and stories using the word processor, create presentations and animation sequences using HyperCard, design buildings and illustrate reports using Canvas, and develop city plans using simulation software (SimCity). Teachers act as facilitators and coaches, guiding student activities, supporting collaborative decision-making and group discussions, and providing critical feedback.

2.0 Classroom Context [*context*]

Teachers. D. P. and D. C. team teach the Yellow Cluster. D. P. has over 20 years of experience as a teacher, with a strong background in open education. She has been at Progressive School for 8 years. At the time of our 1993 observation, D. C. was in her first year as a certified teacher. She had conducted her student teaching in the Yellow Cluster classroom the previous year and was selected as the replacement when D. P.'s teaching partner retired. The two teachers share similar philosophies and work well together. During a joint interview, they build on one another's responses, sometimes completing each other's sentences. Both teachers speak highly of the team teaching approach:

D. P.: *If we weren't a team, it would be much harder.... When one is down the other picks it up.... We have so much fun too...[gives example of timing a child who they knew would find a particular picture in a particular book—it took 7 seconds] There's that adult level.... Teachers are terribly isolated....* D. C.: *The* *curriculum that gets developed is so much richer...you end up coming up with things that you would have never come up with yourself....* D. P.: *In no time.* [D. C. talks about how her house-mate, who is also a teacher, plans in isolation using notes and published resources. She contrasts this to the team approach in which planning takes place on an ongoing basis with D. P.—over lunch, after school, during breaks, etc.]

Students. The "Yellow Cluster" is a 3rd/4th grade combined classroom with an enrollment of sixty-four 8 to 10 year old students. Within the city building project, students work collaboratively in four large neighborhood teams (16 students). The teams are composed by the teachers with input from students' previous teachers in order to achieve a mix of ages, genders, ethnicities, and ability levels.

The class enrollment of the 1993-94 group included a larger number of returning students than the previous year. This proved to be beneficial to the group as a whole, as these students contributed their knowledge and experience to the project.

D. C.: *It's still 3rd and 4th grade, but more 4th graders and we have fourteen kids that we kept. Most of these kids were kept not because of academic issues but because of social and emotional or stability issues. Really they are an incredible powerhouse group, they have pushed the whole level of the class up, because they are able to say we did it once and share their experience with the whole class.*

Previous Technology Experience of Teachers. D. C. had a previous background in using IBM and approached the computer implementation at Progressive "with a lot of confidence." D. P. came to the Progressive School with what she describes as minimal technology experience She had explored LOGO, but felt at that time that it was a limited environment for exploration and learning because the activities did not have a whole lot of meaning to her students. She was open to using technology when Apple came on board, and viewed the training and experience as an opportunity for her own professional growth and learning. Her main difficulty in terms of implementation and use at the classroom level has been the lack of time to explore and develop new uses of technology within the context of the curriculum.

D. P.: *I'm really an open minded person.... I've always made a lot of my own teaching materials so [the computer] seemed like a real facilitator to me. I've never really resisted using the computer. The difficulty for me is the time. I'm married and I have two kids...It's a real juggle.... I spend at least 5 or 6 hours a week outside of school on the computer doing something.*

Both teachers commented that having computers at home was critical to the incorporation of computers within their classroom. This provided them with the needed time to explore and become familiar with the computer at their own pace. It also makes it possible for them to spend additional time developing materials and utilizing the computer in other ways to support curriculum and instruction.

D. C.: *The only way that I am where I am right now and able to do all this stuff with these computers is that they gave us all a computer for home...so I can sit down at my computer, play with it, work with it, do whatever I want to do with it. Apple gave me my computer before I was officially hired here [had during summer vacation].... I had time where I could sit down and say, okay, what's this going to do? ...without that computer at home there is no way that computer technology in our classroom would be as advanced as it is. D. P.: Those 5 or 6 hours, we might spend a couple hours at school figuring something out, then the rest of it is our own time, doing something, answering AppleLink, figuring something out with HyperCard, playing with Canvas. Something.*

Classroom. Progressive School clusters are located in individual rectangular buildings housing two classrooms (previously divided by a wall that has been torn down). The Yellow Cluster is a lively and, when fully occupied, somewhat crowded space. The floor space within one classroom is taken up by groups of desks containing built-in Macintosh computers underneath Plexiglass tops. The second classroom is half-occupied by a mounted model-city-in-progress. Each classroom has a carpeted floor space that is used for group meetings and activities. Shelves with books, both published and student-authored, are interspersed throughout the classrooms.

Colorful student displays cover each of the classroom walls. These classroom artifacts provide a great deal of information regarding the overall curriculum and the city building project in particular. A History Wall documenting classroom activities through student descriptions, photos, and illustrations encircles one classroom. Banners featuring commission reports and activities are also prominently displayed. A large map outlining the layout of the parcel pieces runs along the wall next to the model city. An adjoining poster lists the "Wants" and "Don't Wants" that were generated by students in order to guide their city planning. A large map of the city, with an accompanying magnifying glass, is posted, inviting students to locate the home addresses of their classmates. The entire plan for the school year, created on HyperCard and then blown up, is mounted on another wall. Object costumes, designed by the students as an exercise in scaling and worn in an "Object Parade," run along the top rim of each classroom.

During our visitations, students move about the classroom freely as they engage in a variety of city building activities. The constant hum of conversation and movement is purposeful and constructive. This is a high-energy environment, but it is not chaotic. Students are genuinely excited about their activities and are eager to share their work with us. As they do so, they are exceptionally articulate and we are impressed with their ability to make connections between their individual and group work and its larger context within the city building project.

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

Y	Interdisciplinary
Y	Project-based
Y	Collaborative Learning
Y	Mixed Age
Y	Extended Activity
Y	Part of Core Program
Y	Teacher as Coach

Notes:

Interdisciplinary and Project Based:

The city building project incorporates all aspects of the curriculum: science, math, social studies, language arts, and visual arts. Social studies topics include the structure and functions of city government, which students learn both by studying and observing local government activities (attending a city council meeting, for example) and by enacting the city government process themselves within their model city. Students study the history of the Western City, and they research their own family histories. Each commission is charged with an area of scientific study that relates in some way to their particular tasks. For example, the building and safety commission designs buildings to withstand natural disasters, while the transportation commission conducts experiments in energy and movement and the environmental commission studies water and ecology. Math activities are integrated throughout the project as well: e.g., students build their structures to scale, calculate the number of housing units needed based upon population estimates, work on city budget issues, and program animation sequences within HyperCard. The visual and language arts are incorporated through extensive writing and documentation activities. Students write history wall and commission reports. They select and create appropriate photos, three-dimensional models, illustrations, animations, and video segments for use in presentations and displays. Oral language skills are developed as students present and negotiate their viewpoints within their city building teams.

Mixed Age:

The Yellow Cluster is a 3rd/4th grade, mixed age group class of 64 children. Students are not separated by age or grade; collaborative groups are comprised of a mix in terms of gender, age, ethnicity, and ability levels.

Extended Activity/Part of the Core Curriculum:

The City Building project is a multifaceted project that includes many stages and incorporates all aspects of the curriculum. Students begin by studying the history of the Western City and learning about current city issues and operations. They develop a set of criteria for city building and design and critique their "instant" city. They work in neighborhood teams and on city commissions to design a model city of the future. They simulate life in their model city and evaluate and revise their plans. At every juncture, the students take the lead, and are given time to problem solve and explore their developing plans and ideas. Math, science, language arts, social studies, and visual arts activities are incorporated throughout the project. This is a labor and time intensive project, which comprises the bulk of the school day and lasts the duration of the school year.

On Authenticity of Project:

The city building project is meaningful to children because it builds upon their daily life experiences as individuals living within the Western City It empowers students by providing them with tools for understanding complex urban issues.

D. P.: *The thing that's wonderful about the city building project too is that there is no child that doesn't know something about the city. They live in it. So even children that are from what are referred to as disadvantaged homes, sometimes they have the reality about the city and they can tell you what city services don't work and which bus lines don't run and who has to wait here late...and so it really turns the tables around so that every child's experience has value. And it isn't just the kids that go to summer classes and have camp and all that. They all have input....*

Teacher as Coach/Collaborative Learning:
Teachers provide the project structure, but students take the lead on implementing all aspects of the city building project, working collaboratively and engaging in joint decision-making. Teachers act as facilitators and coaches, providing materials and guiding rather than instructing students; providing critical feedback and supporting students in the process of critiquing one another's work; facilitating group discussions and extending student thinking through their questions. As often as possible, opportunities are provided for students to construct and discover their own theories and solutions.

D. P.: *We could take the point of view of instructing them on how to build a perfect city, a la SimCity kind of a thing, or you let them build it. And the real lesson is letting them build it. D. C.: You can argue until you are blue in the face with a child who insists [that this thing needs to be this big.] But if they build it or they plan it and they start thinking about it, they find "Oh I need to change this." And you don't have to say a word. Everyone does it for you. It's not a battle any more, it's real learning. It's not, I'm only doing this because the teacher told me I had to do this. That's what happened [with the next map]...they each took their parcel piece and drew a map, and of course nothing connected again and they said "Oh yeah, we forgot." And that was one of the first things they said, "We should have talked to each other." And we looked at it again and said, "How many hospitals did you build in this neighborhood?" And they counted 12! And right about then we started taking neighborhood trips, so we'd walk them around their neighborhood and say, "This is your parcel, it goes from here to here," and took a picture. And they realized this is how big the neighborhood was, it's about 15 blocks big. I really don't need 12 hospitals! Each parcel piece doesn't need one of everything,* *and they started to get that idea without the teacher forcing it on them. One of the first things they did when they did the next map was say, we've got to talk to each other.*

D. P.: *Students do a lot of writing in partners and have to edit and make comments on one another's work. They often write individually, then read one another's writing and make comments. And we will in turn say something about their comments, "I like the suggestion you made" or, "Did you think about adding this?"*

4.0 Description of Activity [*activity*]

Early in the school year, the students study the history of the Western City and the workings of city government. They visit City Hall and sit in on a city council meeting. They study the architectural style of buildings and the layout of the city. They learn about their own family histories and design monuments in honor of their family traditions. They study urban plant life and "adopt" local trees for watering and care. Activities across the curriculum are interwoven into the fabric of the larger project—the city building theme.

Students are introduced to the concept of "scaling" through a presentation of *The Powers of Ten* videodisk. They learn directly about scaling and design by creating an "object costume" that is an enlarged version of an everyday object. The students draw their selected objects, then make patterns, and scale them up to a size they can wear as a costume. *Canvas* is used to add details, such as lettering. The costumes are worn in an Object Parade and then displayed in the classroom for the remainder of the school year. This experience is drawn from later, when students build their buildings to scale (reducing rather than enlarging).

D. C.: *At the beginning of the year, the object activities are not as clearly connected until they start doing the city stuff and they say, "Oh this is just like what we did! " They'll plan a building and they'll say, "Well, that is just like Katie's star." Then go look at her object costume, and go back and build it.*

Students are divided into four neighborhood teams (16 students each). The composition of the teams is selected by the teachers in order to achieve a balanced mix in terms of age, ethnicity, gender, and ability levels.

D. P.: *..when we design our neighborhood teams we make sure that they are racially mixed. We say up front that we think that a lot of the problems in this Western City are generated from racial isolation so we're not going to do it. And it opens up some interesting conversations. We've had some incredible conversations about violence and safety.... The kids have a sense that it is a very real curriculum. They know.*

The teams begin discussing how they might create a classroom environment that "is the way that you would want your city environment to be." From here, the students work together to begin designing their "city of the future." Each neighborhood team is assigned 1/4 of the 14' by 8' land site, which is then divided into parcel pieces for which individual children are responsible. Each child receives a land deed for his or her parcel. Their parcel planning and activities are documented in a Parcel Book and in a HyperCard stack. The cover of their parcel book and the introduction to their stack follows the *Powers of Ten* model, taking the reader or user from the world to their land piece or from their land piece to the world (D. P.: *It doesn't matter which order they use in the design of their parcel book so long as they sequence it right*). So they have a depiction of their parcel piece in relation to the city, state, country, continent, world (or in reverse order).

One of the first group projects is to generate a list of the "wants" and "don't wants" for their city. This list becomes a general guide for future decision making. They build an "instant city" where they spend two hours using hundreds of boxes and other household disposables as building materials. When they step back to evaluate their work, they discover the need for more careful planning and communication.

D. C.: *First they make a map...then they go build.... Then we step back and say, "Okay, is this anything like the map?" And they say, "Ahh, nope." Then we talk about what is on the city, what they liked, what they didn't like, things that worked, things that didn't work. Same thing with the map—they discovered that none of the roads connected. Then we go from there, using that as the building block for where to go...from that you get all kinds of things, like, "Remember in Instant City, when we did that?"* [Gives example of one student working on transportation who reminded others how none of the roads connected in order to strengthen his argument.]

After building and evaluating their instant city, the students go on a break (the school follows a staggered vacation schedule). During their break, students are given a list of alternate city building activities, which are optional but are followed up on by many of the students. Many students return from the break ready to share their project activities and eager to continue.

D. P.: *We send home a packet of projects...things like, stand on your street corner with an adult and count the number of cars that go by at three different times on three different days; cut out articles from the newspaper; find buildings that you like.... They're optional.. But they come back charged because they've had time to think about it. We had one child that designed a whole wild cat park with a monorail made out of string and drinking straws.... When she showed that to her neighborhood team, they bought it, lock, stock, and barrel. They said, "Let's put it right here!" So there is a lot of reward for that kind of thing. Although I wish the break were just a little shorter, still it isn't like summer break...they've thought about it a lot.*

Following the break, the students get down to the business of building their city step by step. The scale for city building is introduced (6' = 1/2"), as well as the map legend (e.g., pink = hospital; orange = business; yellow = housing). They begin by drawing bird's-eye maps of their plans, referring to the "wants" and "don't wants" list in their implementations. Housing is a primary concern at this stage of the planning. In the 1992-93 school year, the teachers instructed the students regarding the number of housing units that they would need to provide, given the projected increases in population. Accommodating these numbers led to a great deal of creative problem solving (mathematical as well as logistical and creative).

D. P.: *We go back to their "wants" and "don't wants" list, and always, one of the biggest concerns for the kids is homelessness.... So we start by requiring housing for 1,500 people (a 3 by 3 inch paper square holds 6 people, then how many of those squares do you need?) So if they're building multiple stories, then they just stack up those squares and staple them together, but they're counting multiples of six, so they put the number at the top of the stack and that's how many people live* *there. They first spread out all the squares, and that's all there was room for—housing. And also you start getting into the multiple-use building real quickly because you have no room.... You're dying to build this business, it maybe will have to go on the bottom floor. It's amazing how much their discussions parallel what's in the newspaper....*

D. P. and D. C. are continually thinking of ways to improve upon and extend the project, with the intent of grounding the activity in ways that are meaningful to students. During the 1993-94 school year, for example, they took a different approach to calculating the number of housing units needed, involving students more directly in the process. The result was that students appeared to understand the reason behind the need for additional housing more clearly. In addition, they generated more creative approaches to solving the problem of lack of space and housing.

D. C.: *Last year, we [the teachers] figured it out ourselves...[telling the students:] "You need to provide housing for this many people." This time because they had gone out and counted themselves, they had all that info on their own. We talked about zoning, etc.... This year's class really got into alternative housing plans. We've got underground houses, teams making satellite stations; one team is doing magnet houses...(floating houses work with giant magnets...will have to address the problem that is going to cause with all that magnetic force floating around).... The team that I am working with is building housing on platforms that will be held up by air pressure. Big air pressure jets...in case of emergency, they are planning out and problem solving. Last year we didn't have that kind of variety.*

The students are divided into eight city commissions (with 8 students each; two from each neighborhood group serving on each commission). Each commission has responsibility for some aspect of the city building; they become the experts regarding that aspect and report back to their neighborhood teams. Curriculum areas and classroom responsibilities are incorporated throughout commission activities. For example, the Historical Commission is responsible for naming city streets, building museums, maintaining the classroom History Wall (documenting all classroom activities) and photo archives, and keeping class books in order. They conduct science experiments in archeology and geology. The Building and Safety Commission creates building permits, develops specifications for building safety based on their study of natural disasters, and inspects buildings. They are responsible for keeping the classroom free of safety hazards. The Imagination Commission designs city monuments and gives awards to the most unique land site structures. They study color and light and are responsible for keeping classroom art supplies organized. The Transportation Commission (added in 1993-94) designs the transportation and power systems for the city, investigating traffic patterns and studying energy and movement. They are responsible for keeping track of computer repair needs and overseeing computer shut down at the end of each school day. The Environmental Commission is responsible for maintaining a clean environment through recycling, waste disposal, and safe water systems, based on their study of water and ecology. They are responsible for classroom recycling and making sure that the sinks are clean and usable. The Social Services Commission maintains the health and welfare system within the city, planning for child care, hospitals, and other human services. They study the human body and kinesthesiology and are responsible for maintaining the classroom earthquake bag. The Communication Commission plans the city's communication systems, such as futuristic mail, telephone, entertainment, and information services, as well as schools. They are responsible for recording homework and delivering mail, as well as for representing the class on the Apple Global Network. Their areas of scientific study include communication technology and optics. The Agricultural Commission (added in 1993-94) determines how the food needs of the city population will be met and works with the environmental commission to design city parks. They study food and nutrition and are responsible for watering classroom plants and taking care of umbrellas on rainy days.

Commission members represent their neighborhood groups and return to them to discuss all commission decisions. This often leads to lively discussion and problem solving, which in many ways mirrors the political process within real city governance. For example, the 1992-93 Building and Safety Commission's initial requirements for the size and distance between structures met with a great deal of disagreement on the part of the neighborhood teams. This forced the groups to engage in the process of negotiation, with individual members articulating their viewpoints in order to convince others. D. P. and D. C. feel strongly that this is an important aspect of the city building process.

D. P.: *That was real interesting.... They got up in front of the class...they were adamant about the size [of the structures]. [D. C.] and I knew the buildings wouldn't be tall enough, but we kept our mouths shut.... And what happened is that the kids got increasingly frustrated. They had said that there needed to be five inches between each building. That's a lot of empty space. And six stories tall.... The teams got so angry that they went to the commissioners and the commissioners had a meeting. And then they went to fifteen inches tall, ten stories and an inch between each building. But they never would have gone for that. No way.... The thing I've learned from it is how natural that political process is. We get so frustrated, but it's really interpersonal. It's very much like any other interpersonal relationship, it's just bigger. And we can see it with the children. Nobody has taught them how to run government and make choices or buckle under pressure, those were like phone calls to them—their constituency was furious, but they responded the same way.*

The discussions within neighborhood teams further empower students through giving them an opportunity to address issues that are of critical interest to them, as individuals living within an urban environment and experiencing the day to day issues that entails. During the neighborhood team sessions we observed, students discussed everything from the need for McDonald's and malls to the right to die. (A recent 1994 visitation from a local PBS station doing a piece on schools so impressed the visitors that they are returning to the Yellow Cluster for further taping.) The teachers frequently refer to the value that the project provides in terms of increased student understanding of issues of personal and political importance, and increased ability to act upon these issues in ways that lead to their feelings of empowerment, counteracting the fear and frustration that comes from living in a city like this Western City.

D. C.: *The curriculum gives them a concrete physical outlet for all the feelings. It's if I'm feeling scared about this, maybe if I build this and make things safe, even though it's not really true...it gives them some sort of control of what's going on .*

D. P.: *One neighborhood team put the police station in the middle of the neighborhood...convinced the kids that it needed to include rehab—people who get into trouble just shouldn't stay bad, there needed to be some kind of retraining and job training...so it is pretty powerful stuff. They mention current events, mention what they hear on radio and T.V. and they really feel connected.*

Throughout the project, student's document their activities and develop presentations using technology in a variety of ways. They develop HyperCard stacks on their parcel pieces, their commission ideas, and jointly, on the classroom history. At the end of the 1993-94 school year, they developed a QuickTime project, incorporating video clips of their commission activities.

D. P.: *We will make a traveler button that goes down each of their transportation pathways, lands at each building, pops up a field and tells about that building. And we can also do an animation about building their favorite building and showing that in steps. And the computer really shows action over time a lot better. Except video, which we'll be able to do. They're already working on a stack in HyperCard, their commission ideas, which is just basically a sketch pad. You know, draw this, type an idea on a field, make another card, add another idea. That's a kind of portfolio for them too.*

History stacks are posted around the walls, along with a planning chart with the plan for the year, which estimates our activities. We have translated those into HyperCard templates and each one of the little titles that is on the planning board is a button, and the button then will contain the child's writing (with a partner) about that aspect.

D. C.: *QuickTime was a commission project. First each commission talked about what they wanted to film—what could they best capture on film as opposed to another media. Then we filmed it and we came into the lab and we connected the camera to the computer and transferred it to computer images. They had to edit what they shot, because the QuickTime clips take an enormous amount of memory. So they had to go through a lot of talking about, "Okay, what part is the most important?" They designed their card, font, developed a presentation of their video clips. Each commission card looks different. Most of them are info interspersed with video clips. They wrote their descriptions of the experiments. Doing that led to where every single kid could tell you what every single other kid in the other commissions were doing. The interactions were interesting.... Water and Power wanted a picture of every kind of bubble experiment and every kind of child...another commission wanted a particular shot because they liked how my hair looked. They also talked lot about content: "This particular shot isn't going to* *work, because it doesn't show what we want it to.".... A lot of synthesis about their overall commission picture.*

Beginning in the 1993-94 school year, the use of SimCity (a simulation city design program) was incorporated into the project. It was adapted for a particular use within the project, as a planning and feedback/evaluation tool for neighborhood teams.

D. C.: *We used (SimCity) with neighborhood groups and used every other week to plan. Every time we would get to a certain point, we would print it and look at it and say "Okay what do we need to do? Why is this certain thing happening?" They liked to look at the evaluation part and see what the citizens thought and say, "Okay, the problem is pollution, so what do we need to do to solve this problem?" or housing costs. We got into a lot of city issues that we didn't get into last year, like housing costs...it prompted a lot of good conversations.*

Technology is used as a tool, rather than as an isolated focal point, within the context of accomplishing meaningful and varied tasks. When D. P. and D. C. discuss the city building project, recurring themes are the importance of connecting activities to a meaningful context for students, providing them with opportunities to construct their understanding and knowledge as directly as possible, letting students take the lead, while at the same time providing clear guidance that facilitates their thinking and development. They also stress the need to accept different students' varying ways of making connections. Technology is viewed as a facilitative means, supporting the goals that underlie the project.

D. P.: *I think that's real valuable. But it's directed. Sort of like we do with SimCity. We don't say, "Okay kids, have fun, make your city!" We take a neighborhood team, we sit down, we start building our city, we print our city, and then we go back and we say, "Okay, what do we want to do next?"*

All this is very rich (the technology use), but it's got to be grounded in curriculum. It can't just be a cool project. It's such a temptation because it's so jazzy...it's one of the things that I've learned about the city curriculum designed by D. N. It really does organize things in a meaningful way. It's not that what your teaching that is *different, it's the reason you're teaching. It's what you plan and how you organize. It's also a way to decide which things to leave out.*

...I think it's very important to ground these experiences in something very real or else it's difficult especially at third and fourth grade. We keep feeling like we need to go back and say "let's build it with are hands, let's build it here and draw it there.... "

The city building projects lasts the duration of the school year. The final phase consists of students enacting life in their city, which leads to further problem solving and implementation as they discover first hand the aspects that are in need of further resolution or alteration.

D. P.: *We'll aim for getting the city built by the end of April. And then what we will do is enact life in the city. Each child will be asked 'Okay, where do you live? Where do your work? Do you have children? Do they go to school?' And that will force them into some rebuilding because they are going to leave a ton of stuff out. I can already see tendencies towards lots of malls....*

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y	Microcomputers
N	ILS
Y	Other LANs
Y	WANs
Y	CD-ROM
Y	Interactive videodisc
Y	Videocams and editing equipment
Y	Word processing
Y	Spreadsheet
Y	Hypermedia
Y	Animation
Y	Simulation
	Other

Notes:

The classroom is equipped with 30 networked Macintosh computers, a laser printer, a scanner, a VCR, and video cameras with access to QuickTime for digitizing video. A laser disc on *Powers of Ten* is used to demonstrate scaling. Students create Commission stacks and animations in HyperCard, design and scale objects in Canvas, create a History Wall database, and use MacWrite extensively for word processing. The simulation program, SimCity is used for designing, critiquing, and revising initial city plans.

Future technology plans:
The teachers have plans to incorporate other uses of technology in the near future. D. P. would like to incorporate the use of a spreadsheet (Excel) for graphing and calculation activities within the city building project. She would like students to engage in more extensive survey research (*"...how many people live in your parcel, where do they work, what do you think the jobs in the future will be?"*) Excel could then be used to calculate and graph results.

D. P. would like students to develop greater skill in using "descriptors" to search for topics and information using resources such as the Internet and CD-ROM reference disks. Up to this date, students have used the print encyclopedia only. Each cluster was given a CD-ROM encyclopedia, and Apple has trained teachers in using it, but teachers have found that it slows down and can lock up the entire system when the CD-ROM is used on their local area network.

[On the reason for teaching about descriptors] D. P.: *If you're doing a report on the heart and you want to find resources—you would need to know the word 'heart,' you might also need to know 'human body,' you might also need to think of 'circulation'—kids need to be able to sort out those pathways, because that's how they are going to get into the databases that will give them the information they want. We need to be teaching that. It fits right into what we're doing with the Commission right now, because each Commission has a topic and...(we spent a ton of our own money on books) so they are getting info. The hands-on encyclopedia is what they will use first and then onto the computer version.*

D. P. would like to continue to incorporate video and QuickTime into student work and presentations. She refers to this technology as "a natural extension" of other City Building activities: *"I'm excited about the video.... I think that it is something that is really going to personalize for children and put them more in the technology driver's seat. Even more than a laser disc, because that's still somebody else's footage, and just because you select it doesn't mean you understand it."*

Both teachers feel that telecommunications is a potentially rich avenue for extending student learning and communication skills within the project. For example, students could compare the cost of housing, transportation, and food within different cities, or could engage in discussions with students in other classrooms focusing on topics that arise within the city building neighborhood groups. D. P. comments that lack of time has been the primary reason for not including this and other elements so far. (*"It's just a matter of how many things can you do."*)

In 1994, the school was awarded a Chapter Two grant ($19,000) that will enable three clusters (including Yellow) to connect with Internet in order to extend their project activities. This mini-project will involve linking students with the photography archives of the city's Museum of Photography. The photos will be used within students' study of the history of their city. The teachers are excited about the possibilities for using Internet in other ways beyond downloading images, but they are still in the early planning stages. They would like to be able to link with other classrooms eventually. Training on the use of Internet will be provided to the participating teachers this summer (conducted by part time teacher, Jane, who helped write the grant along with an Progressive School parent). The school will write additional grants in the hope of gathering further funds to support the use of Internet.

D. C.: *We are going to link up the state's Museum of Photography, for photos that they have put on the computer, we will be able to download those images. We have a land site stack, with the traveler that goes around their parcel. We'll probably find a way to appropriate it into that. We study the founding of [the western city], so we will work it into that.... We are going to take color zap shots that we can feed into the computer, take shots of their sites and merge them with historical shots.*

D. P.: *Doing something like going to the museum and looking at the images, then coming back and calling them is an amazing thing...that pretty clearly gives the Internet a place, it is not just a magic thing, it's a connection to a real place with a real data system of its own that is like your History Wall, or like your Planning Wall or like your HyperCard stack and maybe someone would like to see yours.*

D. C. and I do a family interviews project, talking about family origins, so this will fit right in for us...download images from people in different places around the world and talk about what their life experiences might have been like...where most people settled and what that meant to the history of the United States. That really fits right in, as well as the city history, history of city buildings...there's a lot we can use.

Also in 1994, the Yellow Cluster was awarded a small Educational Partnership grant (through the school district; the money was supplied by Toyota) grant to incorporate Lego LOGO into the city building project. Students worked in groups of 8-10 to build Lego cars and then to program their operation. More extensive Lego LOGO activities are planned for 1994-95.

6.0 Technology Use *Classification and description of how technologies were used*

- Student Uses **[*kiduse*]**

Tutorial ***[tutor]***
The only tutorial software used is a keyboarding program that students work with at the start of the year.

Exploratory ***[explore]***
Yes. The students use simulation software, Sim-City, to explore and critique their initial city plans. Rather than building the simulation as provided for within the software program, Yellow Cluster has adapted its use for their own purposes. City plans are drawn up in neighborhood teams and printed. Feedback is provided within the Sim-City software regarding problems related to their initial plans (e.g., pollution, not enough transportation). Students take the feedback and printouts back to their groups and discuss needed changes. The plans are then revised and reprinted.

Communication ***[commtn]***
Yes. Students on the Education Commission represent their class in communicating with other schools over the Apple Global Education network. Once a week, a member of the commission joins students from other Progressive classrooms in sending and receiving messages from participating classrooms across the country on a variety of topics. The week of our first visit, students

were selecting their favorite jokes to send, while reading and critiquing the jokes they had received, over the network.

At this point, telecommunication has not been fully incorporated into the city building Project. However, this is an activity that the teachers are planning to include more extensively in the future.

Tool ***[tool]***

Yes. The primary use of the computer within the City Building Project is as a tool. Students use word processing software (MacWrite) to write their city plans and descriptions. Canvas (a drawing program) is used for designing objects and buildings. Students create Hypercard stacks and animations to demonstrate their Commission plans and city building activities. There are plans to use a spreadsheet (Excel) for calculating comparisons and graphing survey responses.

Also in 1994, the Yellow Cluster received a small educational partnership grant to incorporate *Lego LOGO* into the city building project. Next year, students will use *Lego LOGO* to design and build models of solar-powered greenhouses, which they will program with computers. The greenhouses will be designed to have their doors open when the interior reaches a certain temperature.

- Teacher Uses **[*tchuse*]**

Communication

D. P. and D. C. communicate with teachers in other Apple supported classrooms and schools, as well as with personnel from within the company, via AppleLink. In addition to providing another vehicle for technical support, their participation over the network has given them the opportunity to learn from the implementation stories of others. D. C. comments that this process has helped her appreciate some of the unique qualities and characteristics of her school, while also finding relief and comfort in the knowledge that other schools have experienced many similar challenges along their pathways to implementation.

D. P.: *We use AppleLink for messages from people within the company [Apple] a lot. We haven't explored it with the kids [have plan to, again it's a matter of time] D. C.: That's how I know about ACOT schools. We send them our* *newsletters and they send us theirs...It's neat to see somebody else's because they're doing it from a slightly different approach. I hear a lot more from them about technical problems of everybody trying to do something at once. It's really interesting to see that someone else is using computers and what they are doing with it and also [I learn I'm not the only one with technical difficulties].*

Presentation

The *Powers of Ten* laser disc is used to introduce the concept of scaling to students prior to their object building activities. D. P. and D. C. create their own classroom materials (e.g., student guides and activity instructions) with the aid of technology. They are especially pleased with the way that they are able to individualize these materials, given the flexibility of a word processor.

D. P.: *And also for us the computer is wonderful...because a lot of what you see the children doing in the classroom we wrote. I mean we're writing the follow up for the reading and it's not like when I started teaching, you'd get out the ditto, the machine jammed.... Now it's if I make a typo, I go back and edit it, I print however many I need if I'm really in a jam for time, and I give the kids something meaningful that relates to their book and includes maybe a great question that one of them brought up. It's just very different. And it's not a strain, it's a joy. Because we can incorporate the children into the instructional materials and it's a pleasure.* D. C.: *Like our first step in the commission book this time—we wanted them to find facts. So with the computer it was really easy to take the basic outline to finding facts and adapt it for each book and each commissioner so that it was really exactly on target for what they were doing and what the book was about. Instead of having to recreate the same thing or giving each child the same thing that wasn't perfect, we got eight different commission things that had the same basic idea but that were very related to what they were doing.*

Instructional Management

D. P. and D. C. do not mention the use of technology for grading or monitoring student progress. However, the work created by students on the computer provides them with an ongoing record of a student's activities. Since the school does not give letter grades, interactive, informal feedback is the norm. Progressive School teachers have talked about developing a linked system of record keeping that would connect spreadsheets, comments, and conference records.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration
  Yes. Peer to peer collaboration is a central component of the City Building project and the Progressive School approach in general. Technology is viewed as another context in which student collaboration is facilitated.
- Independent exploration
  Yes. D. P. and D. C. espouse an approach to teaching that creates a structure in which students explore and discover concepts independently and in collaboration with one another (rather than through teacher talk). Technology becomes another tool for student-centered exploration and discovery within the classroom.
- Access to outside information resources
  Yes–in the planning stages. D. P. and D. C. feel that telecommunications will provide rich opportunities for students to learn about life in other communities. The Chapter Two project will provide ongoing access to resources within the city's Museum of Photography. Future plans are to extend student access to information resources via the Internet.
- Support for higher-level thinking
  Yes. An important goal within Yellow Cluster is for students to develop high level thinking and problem solving skills through active and extended involvement in a complex project. The use of technology extends the depth and complexity of what children are able to do within the project. In addition, the use of technology in itself provides many opportunities for complex problem solving.
- Creativity
  Yes. Technology is described within the school brochure "as a mechanism that excites children's imaginations and exposes them to a host of experiences..." Tool uses of technology support creative expression through the visual (e.g., drawing, animation and design) and the language arts (e.g., story writing and poetry).

- Technology skills

  Yes. The development of technology skills is viewed as an integral component of the curriculum. Skills are taught and learned within the context of meaningful projects, rather than in isolation.

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***

  D. P. comments that the students appear to be more interested in writing due to the use of the word processor. The specific uses of the computer for writing, animation, HyperCard stack building, design work, and QuickTime presentations are all referred to as motivating to the students. D. P. believes that students love to do many things on the computer; however, the key is that these activities are embedded in the curriculum, which in turn is integrated within the context of a project that is meaningful to students.

- Attendance, time on task, discipline ***[kidbehav]***

  Our classroom observations and teacher comments indicate that the students are very much invested in the city building project. They are articulate and often passionate in their descriptions of their project activities and in their neighborhood discussions. Technology use appears to be focused upon project-related activities–more directed in this way than is often observed within classrooms. Time on task appears proportionately high and discipline issues are relatively minimal. Again, this is a function of the entire approach, of which technology is an underlying component.

- Amount of collaboration & cooperative learning skills ***[cooplg]***

  The entire city building project is organized around small- and large-group activities. The use of the computer facilitates the sharing of writing, and the sharing of tasks. One drawback of the placement of the computers under a Plexiglass-covered desk is that it makes it more difficult for a group of students to share a single workstation, or for one student to conveniently look at another student's work. Nevertheless, students often work in pairs at the computer. Commission and parcel stacks are developed by individual students; the History Stack and the QuickTime presentations were group projects, within commissions. The QuickTime project in particular led to a great deal of cooperative problem solving as students decided how to focus their presentations, what images to use, how to sequence text/images, etc.

- Ability to manage own learning ***[selfreg]***

  The Yellow Cluster is an environment in which children are encouraged and allowed to manage many aspects of their learning activities generally. Technology becomes a tool for supporting this process, but it is the teacher facilitation, modeling, and support that appears most critical. The teachers comment that their approach to using technology with the students has shifted from a more step-by-step approach to allowing students more control over how they use the equipment. Shifting versions of software and observing adaptation on the part of students appears to have increased teacher confidence in their students' abilities to manage their own learning.

  D. P.: *We have continually upgraded the machinery and software since we began. We've been through 3 or 4 versions of HyperCard; used to use MacPaint and now use Canvas as a drawing program; 3 or 4 versions of MacWrite and AppleLink. These changes have taught us flexibility. Just as soon as you think you've got a handle on something, it disappears or version 4 comes out.... That has given us as a staff a little gentler approach. I used to spend a lot of time when we began preparing step by step lessons that were forty-two pages long, where the kids would check off their computer lesson as they came through ("Did you do this step?") and now I just don't even bother, because they can only be used once. And a lot of times the kids skip through steps that they already knew. I think it really reflected the growth in our confidence. To be able to say, "Well, this is how you do it. Let me know when you get stuck." The printed directions are much less mechanical and often ask for student input and record keeping, which they individualize to their particular project needs.*

  The computer is used to generate overall plans for the school year (on HyperCard). Having the overall plans available to the students (blown up icons depicting class activity plans through the school year) has made students more aware of the educational goals within the program, as well as more responsible towards the achievement of these goals.

- Access to outside information resources ***[outinfo]***

Students on the Communications Commission participate in the Apple Global network, representing their class in e-mail discussions with students in other classrooms across the country (on a wide variety of topics). Future plans are to provide further access to outside resources through the use of Internet. This raises many instructional and pedagogical issues, which D. P. discusses in the context of our interview:

D. P.: *Doing something like going to the Museum and looking at the images, then coming back and calling them is an amazing thing...that pretty clearly gives the Internet a place, it is not just a magic thing, it's a connection to a real place with a real data system of its own that is like your history wall, or like your planning wall or like your HyperCard stack and maybe someone would like to see yours. Rather than giving it this twilight zone, "Oh let's go to the Internet!" ...I think it's very important to ground these experiences in something very real or else it's difficult especially at third and fourth grade. We keep feeling like we need to go back and say "let's build it with are hands, let's build it here and draw it there...", and I think it's real true of the Internet.*

I also have some concerns about the ethics and the availability of the materials for kids. What is it that's okay for them to be looking at? What can we do about pornography on the net? How can we protect and teach in this environment? How can we possibly monitor what they are finding out? Do we want to? What is it going to mean to have five kids on Internet looking up information that they can't read because they've gotten into a library that has too difficult a vocabulary? So what do I do? Do I run from kid to kid translating? Do they download, print it out and take it home? I mean those are some of the real things that are going to be the issues.

There is going to have to be a kid's strand somewhere that is developed. Because we even have that difficulty finding appropriate materials for the commission information for kids with reading materials. It's only been in the last five years that you could get your hands on...we spent a lot of money getting good reading material for the kids to read in their commissions...but it took a lot of time to find this material...third-grade level material on the human body; books that gave information not, "You have a nice body..." Then when you pull out

Encyclopedia Britannica and it's in print this big and you can't use that either. So somewhere in the middle is the information with the text that supports it at the kids level. That's a real important piece that needs to be thought about.... Those books need to be on line and scientists that are interested in teaching kids and working with them need to be available and either they have to be people that work with kids or have kids and have some kind of notion of what kind of vocabulary (to use) and give accurate information that's sensible. The kids are hungry for it. I can't give information fast enough to the commissions...they want to know why the paint pigment mixes differently than light pigment. What light does. Why do we see these three colors on the computer screen but when we mix paint we see different primary colors? I just can't dig fast enough to provide it.... That is a telecommunications issue that is at the core of it.

As a high school or university student—they can dig their way through; my high schooler can and she knows when she's lost: "I need to go check with the coordinator at my school, I don't understand this information".... Even if the software printed a map...of the pathways that kids had taken and if the kid keyed into their account, typed in their name and then once a month instead of a phone bill you got a pathway, then at least you'd know, "oh he's on this and I could support it with literature" ...and the kid feels not necessarily monitored but supported. And it's not like wandering through some information jungle.... They just kind of get off on a branch....

I really think the videotape stuff, filming what they are doing, sharing it with other people, getting feedback and reacting to the feedback—I think that that is what Internet is about. For this age group that is the most valuable. The information search stuff (and it would be exciting to work on development of a kid's line—until then, what are they really going to do on their own that is valuable independently and how am I going to pay for it? We could run up some major money.) Taking a commission and having them get on CD-ROM and find information; that's analogous really. I think that's real valuable. But it's directed. Sort of like we do with SimCity. We don't say, "Okay kids, have fun, make your city!" We take a neighborhood team, we sit down, we start building our city, we print our city, and then we go back and we say, "Okay, what do we want to do next?" So it's a building thing. You've got to be real careful. It's easy to make Internet into a baby-sitter. It's fascinating, it will hold my kids' attention for hours.

- Support for higher-level thinking ***[higher]***

  The computer's use as a tool to support complex tasks defines it as an environment in which students are engaging in higher-level thinking skills. As a word processor, it provides a context in which students engage in composition across a range of genres. As a design environment, it provides opportunities for students to explore alternative approaches to the design of buildings and other objects, using complex concepts of scaling and dimensionality. Using HyperCard, students develop complex procedures for achieving self-determined goals (such as animation sequences). The use of QuickTime involved complex problem solving regarding content and presentation issues--how best to communicate information given the characteristics of a particular media. Within the city building project, technology best supports higher level thinking when it is connected to a multifaceted, complex project.

- Complexity of task students can accomplish ***[taskacc]***

  D. P. feels that the use of technology expands what students are able to do, allowing "multiple approaches" to a variety of tasks. This reinforces student learning, and gives them an opportunity to explore which media are best suited for particular kinds of information presentation. Both teachers have commented that the technology adds to the level of problem solving students undertake. The QuickTime project at the end of the 1993-94 school year, for example, involved critical decision making around content and presentation issues (What was most important commission work that could best be represented on video? What could be communicated via text versus image? How should these pieces be orchestrated and sequenced?).

  D. P.: *Now when we're talking about designing a curriculum, now we can embed what we want into the computer—that's pretty exciting. The city stuff that has developed over time in our cluster in particular is just loaded with possibilities. We've got maps scanned in, we've got each kid's parcel pieces on the computer in a major HyperCard stack, we've got a History Wall stack that documents everything that's up on the history wall around the room.... So a lot of what we are doing gives the kids another version of things they do in other ways. That's real rich not only technically, but for the grade level in terms of the multiple approaches. I like that there is a parcel book, but you also have a parcel stack.*

And these are the things that show up best in your parcel book and if you want to show some kind of movement, then you are probably going to want to use the computer, because you can't do that in a book.

- Learning on specific tasks ***[kidlearn]***

  Both teachers mention the development of writing skills, especially the increase in editing that the word processor appears to support.

  D. P.: *Where it really helps is writing because it's so easy to edit. There is none of that painful feud with the pencil for a late developing fine motor kid whose got that cursive all over the page and just really would like to write just two sentences and then put that pencil down because their hand is in a major cramp. [Many compose at the computer, some don't. Teachers don't make rules about that.] For some children, seeing words printed makes them recognize errors more readily. Because usually when you read a text document there aren't errors in it.... It's sort of like it looks double wrong if its typed and wrong. It's just another element. It's got to be a configuration clue of some kind that's different from the manuscript clue. The kids want to write more is all I can say.*

- Creativity ***[create]***

  D. C. comments that students are learning how to represent two- and three-dimensional shapes, increasing their perceptual skills in the context of their drawing and animation activities at the computer. Both teachers mention that they are often amazed at what the students come up with in their design work. Technology appears to support student exploration of alternative approaches, an important aspect of creativity. It allows students to manipulate the variables of design, altering various aspects and learning from the results. SimCity provided an impetus for more varied approaches to solving the problem of housing and lack of space.

  D. C.: *The thing I've noticed about animations is that it really increases their perceptual skill 'cause if you look at some of their animation...* [describes golf ball getting hit and getting smaller, worm moving and showing different views. The perceptions of looking at the world and how to convey that are much more realistic.].... *We started learning about two- and three-dimensional shapes...they drew the objects on Canvas. Now we are doing geometric T-shirt designs and you can see that they have learned how to represent two- and three-dimensional* ✓

objects using Canvas. There is a lot of description work. They do their costume on Canvas. [Their holiday gifts involved making a frame with a drawing representing different views of their costume on Canvas]....

- Greater attention to how a product will be understood by others ***[audience]***
  In writing and in putting together their animations and QuickTime videos, students are given opportunities to pay careful attention to how their products will appear to others. They spend a lot of time discussing these issues within their groups. D. C. feels that students look at their writing differently on the computer; that they are more aware of audience in this context.

  D. C.: *They also do more stylistic things in terms of how the paper looks and if there is something they want to emphasize, they'll change the font...they're looking at the words that they're writing in a different way. They're not just thinking about writing a sentence, they're doing that, but they are also thinking about, "This is a really important word." or, "This is something I want to stand out." And they're thinking in another completely different way about their audience.* D. P.: *They are truly designing their writing.*

- Technology skills ***[hackskl]***
  Students have a high level of access to computers and their use is embedded within a wide range of meaningful tasks. Given this, they are acquiring a variety of technology skills that appear to transfer readily from one task to another. Word processing skills, procedural skills associated with HyperCard programming, computer animation and design skills, all of the skills associated with utilizing the computer as a presentation tool for text, animation, video and sound—all of these technology-oriented skills and others come into play. More ✓ importantly, students are learning the "why" in relation to the "how to." Their use of technology is integrated into the goals associated with real tasks within the project. The concept of technology serving as a tool that facilitates a wide variety of tasks is constructed on a daily basis. From the teachers' standpoints, technology know-how in and of itself is not as noteworthy as the understanding of its broader use and functionality.

Both teachers note that there are aspects of technology that can divert students' attention form more important issues within tasks. In writing, for example, students may become overly concerned with the look of their texts, spending too much of their energy and time on attending to the surface issues, such as font type or size. In some cases, D. P. and D. C. may actively redirect students when this kind of "off task" technology focus occurs. When possible, they also take preventative measure, like limiting the font choices in the word processor menu.

D. C.: *...Fonts, I just hope they don't get carried away with them.* D. P.: *That's one of the reasons that we limit them. We have a lot more fonts on our computers than we let the kids have because otherwise they would be fonting all day.*

- Atmosphere of Classroom

D. P. comments that the use of technology has altered her approach to instruction, changing the atmosphere of the classroom. She is not the center of instruction and the computer seem to facilitate this. The social environment is more relaxed and there is an impact on how students perceive one another. D. P. describes this impact in terms of the addition of another hierarchy in which students who are not recognized in other academic realms are valued for their technology skills.

D. P.: *It's a much more relaxed atmosphere...it's made me feel like I'm not in charge all the time in the same way. It's a much more facilitating atmosphere because the kids help each other so much on the computer. It changes the style and the tone of the classroom a lot. I think that the city building curriculum does too, but the computers somehow make that happen faster. All I can say is that you have children who maybe aren't good at the academic things that may be really good at the computer and so it gives another hierarchy, so you have a math hierarchy and a reading hierarchy and a PE skills hierarchy and then you have computers and there may not be much overlap. But it gives the children a chance to excel in more areas and to take control.*

- Self-Confidence

Technology is viewed by both teachers as an empowering tool, providing students with a context in which they can be in control. Students take pride in the notion that they are able to use computers in ways that many adults (including their parents and sometimes teachers) are not yet able to do.

D. C.: *I see more confidence in the kids here.... I think that it's not just computers, it's a multitude of things, but they can do things on the computers that most of their parents can't do and that's very empowering and very exciting for them. It's, "I can sit down and make this machine pretty much do what I want to," and there's something about that that gives them an extra little boost of, "Wow I'm a pretty special person."*

Obstacles to Implementation

- 1993 Strike Threat

  A work slowdown and strike threat at the onset of the 1993-94 school year delayed curriculum planning and implementation. The consensus approach to decision making sometimes delays the implementation process, although no one is suggesting that this approach be altered.

  D. P.: *The strike [threat] put a lot pressure on the whole staff this year—a big sense of treading water until we knew that would be resolved, there were a lot of thing that we would have started sooner. These kinds of things have tremendous impact. Plus this staff, we work real hard at making decisions cohesively. So even the little things take eons of time because we really work to hear each other out. We have Wednesday lunch meetings and during the strike we were meeting every day at lunch for three weeks....*

- Low Salaries/Lack of Respect for Teachers as Professionals

  Within the Progressive School community, there is a strong sense of professionalism among the faculty. This is manifested in the level of involvement and expertise on the part of teachers, as well as in their ongoing commitment to professional growth activities. One of the most noted features of Apple's involvement at the school has been their treatment of teachers as respected professionals. Teachers were paid by Apple as consultants and their ideas and input were highly valued. This experience meant a great deal to D. P. and D. C. It is contrasted with their treatment at the district level, where low salaries and lack of interest in what teachers have to say has had a negative impact upon morale.

  D. P.: *Funding is a major issue.... And it's not just the money, it's the implications toward the careers that everybody feels. We have wonderful* *support and there's incredible energy. But I still took a 10% pay cut, and D. C. is working for less than anyone should...those kinds of pressures have a tremendous impact.... I have strong feelings that if it weren't such a female profession, it would be different.... I don't feel that anyone in the district or the state really cares about me as an individual teacher.... They may want to bring in 85 people to see the classroom or the school that they think is working well so that it will benefit their personal image, but down to the caring level of the children and the worker? No.* D. C.: *LEARN (proposal just adopted by the city's Unified) thinks that this is an incredible place, but didn't ask anybody here anything about their proposal. They call us an example school, but no teachers were asked to be on any of the committees.*

- Lack of Space and Power

  An initial implementation issue was the lack of appropriate space and power to support the large-scale integration of computers at the classroom level. The school's relocation to a new site presented an opportunity for the needed physical restructuring.

  D. C.: *At the site we were at previous to this, we didn't have the electricity to run the computers. At the same time Apple adopted our school, we found that we were going to move to this site (with no notice—it was "a done deal done to us"). We had five computers in each classroom, except one classroom that had 15 or 20 because they were on a different mainline and they had the power to run the computers. If everyone had all five computers on , the fire alarm would go off! There were all the problems connected to how do you manage a small number of computers (turn taking, etc.). It was just horrific. The scheduling and managing of turns and if it was fair...until we got to this site and the first thing Apple did was make sure that we had the necessary power, and as soon as we had that, then the machines came in.*

- Large Class Size

  During each of our site visits, D. P. spoke of the difficulty in providing a quality education given a large class size (61 in 1992-93; 64 in 1993-94). She expressed her frustration with not being able to provide enough individualized attention, support, and feedback. During our second visit, she stated that she felt that children's test scores would be raised appreciably if only class sizes were reduced.

D. P.:...*another thing that plays into how many things you can do is the class size. No matter how you get around it, 61 kids is a lot of kids. When we have a pull out program where a fourth of the kids are out, like on Monday, they were doing music appreciation with ukuleles, the classroom hums...it's like rats in a cage, all that itsy bitsy classroom discipline stuff that nobody wants to deal with is diminished. That's something that the state and the nation needs to deal with...quit trying to quote meaningless research that says classroom size doesn't make a difference....*

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	Programming and Problem Solving in a 4th/5th Grade Classroom
Teacher:	C.A.
Site:	Progressive School

1.0 Summary [*sum*]

The "Blue Cluster" is a mixed 4th/5th classroom at the Progressive School in a western city. The ethnically diverse group of 61 students is team taught by two teachers, C.A. and D.D. The school embraces a philosophy based upon the progressive movement in education, emphasizing student-centered, project-based, collaborative learning. The use of technology is interwoven throughout the multidisciplinary curriculum, which is organized around particular themes. Each cluster in the Progressive School is equipped with 32 computers, allowing for a high level of individual access and use. Within the Blue Cluster, the computers are used primarily for writing (MacWrite), graphic design (Canvas), and programming (HyperCard). Computer-supported writing consists of editing and formatting texts as final products (first drafts are pencil written). Students learn graphic design in the context of preparing monthly "Mind Movers" in which four teacher-selected and five student-selected problems are organized and presented in a graphically pleasing manner on a single page. Students engage in a variety of HyperCard programming activities, which are integrated with various aspects of the curriculum.

In a special project conducted in collaboration with an elementary school in another city, students are using HyperCard to create animations of creatures and environments within a simulated two-dimensional world. In addition to sharing their disks with HyperCard solutions to the problems that such a world introduces (e.g., how creatures see, move, eat, pass one another), students from the two classrooms exchange videotapes in which they describe and enact their proposed solutions. The project combines writing, math, physics, and programming and lasts the duration of the school year.

2.0 Classroom Context [*context*]

C.A. has taught for 25 years in the district. She has taught at the Progressive School for 15 years, since the school's inception. Prior to this, she taught lower elementary grades within the district. She describes her instructional approach as always having been "individualized and progressive." However, prior to coming to Progressive, this approach was conducted "in the closet." When Progressive was created by a group of parents and educators, C.A. was invited on as a teacher who shared the philosophy and goals of the program.

C.A. began using technology about 9 years ago "with much trepidation and fear." The level of technology training and access provided by Apple through the Vivarium project was extensive (summer institutes, 32 computers within each cluster, a working lab, on-site full-time technical support). C.A. has become an avid and skilled computer user, designing materials and simulations for students and working with Apple programmers as a consultant in the development of software modeled on the Planiverse project. She described the impact of technology on her instructional practice in terms of her increased appreciation for and understanding of the learning process, from the perspective of the learner as well as the teacher.

For me it's had a major impact because it put me back in the role of a learner. You forget what it's like to be a learner. I got started using computers 8 or 9 years ago with a great deal of trepidation and fear. That is what humbled me greatly... understanding what that is like...that fear of the unknown.... I don't know it, therefore I'm afraid of it. I can understand better now children who are reluctant to learn math; there is an enormous, 'If can't do it, I'm going to shut down.' I worked through all of my fears and developed a better understanding of the kids.... I don't remember my fears as a child about learning, so this brought back whatever was in my past maybe. So I changed my whole way of looking at learning, the steps that it really takes to teach the kids something and how patient and minutely detailed I need to be...students are becoming more willing to throw off the reluctance, the more they work with the computer and the less fear they have of it and the more capable and good they feel about the 'I can do it.'

The Progressive School is organized into multi-age clusters (encompassing two grade levels) of 64 students, taught by teams of two teachers. C.A. teaches the 4th and 5th grade "Blue Cluster" with D.D., who has taught at Progressive for the past 5 years. Each cluster is housed in a pair of long "box-car" style buildings. The space is divided into student work and learning center areas; a significant proportion of the available floor space is taken up by groups of desks equipped with computers (under Plexiglas tops with pull-out keyboards to allow for a desktop work surface). There are 32 computers for every group of 60 to 64 students, enabling a high level of access. Within the Blue Cluster, three applications are used: word processing (MacWrite), graphics and calculation software (Canvas), and HyperCard.

The Progressive School curriculum is a thematic curriculum that is developed by the school as a whole, leading to a great deal of coherence between the different clusters. The school's mission statement describes the curriculum as follows: "Subject areas and disciplines are integrated and interrelated in a richly networked curriculum organized around a thematic focus. The transdisciplinary curriculum connects subject areas to central concepts or key ideas. Skills, activities, projects, and higher-order processes are used to construct meaning, solve problems, and discover relationships...." The major Blue Cluster themes are U.S. history and Marine Studies: Planet Ocean. The focus of these overall themes alternates on a yearly basis (between history pre- versus post-Civil War and between the Kelp Forest and Ocean Mammals), so that students remaining in the cluster for the full 2 years will have a different focus each year. A schoolwide theme is the relationship between "man and his environment."

3.0 Reform Features [*feature*] *(Classification of reform features illustrated.)*

Y Interdisciplinary
Y Project-based
Y Collaborative Learning
Y Mixed Age
Y Extended Activity
Y Part of Core Program
Y Teacher as Coach

Notes:

Interdisciplinary/Project-Based/Extended/Collaborative: Social studies, writing, reading, and visual arts are integrated into the U.S. History curriculum; science, math, writing, reading and visual arts are integrated into the Ocean curriculum. Technology use is integrated throughout the curriculum. The overall units are extended throughout the school year; students work on a series of short- and long-term project-based activities in collaborative groups. Programming in HyperCard is an ongoing activity across subject areas. Two 45 minute sessions per week are devoted to Planiverse activities.

Mixed-Age: The class is a 4th- and 5th-grade mix of ethnically diverse students.

4.0 Description of Activity [*activity*]

Technology is used within C.A.'s classroom for three primary activities: programming (HyperCard animation), writing (editing and final production), and graphic design. These activities are integrated throughout the curriculum, which is organized around the themes of U.S. history and the study of the ocean.

HyperCard programming is used in the Blue Cluster as a vehicle for learning mathematical concepts and developing scientific reasoning and problem-solving skills. C.A. believes that the activity of creating animations is motivating to students, and provides them with a context that enables them to grasp concepts that would be difficult to understand or to act upon in another medium.

I believe strongly that the kids should learn programming. I use math as an impetus for teaching them the programming and animation to motivate them to learn the programming. One of the things we do...is to have the kids write down what it is that they want something to do or that they want to do in plain English. Then we go through it and we talk about how the computer might help us to do that real quickly. In math or in any scientific investigation, you have hypotheses, you have "If...Then..." statements; the same is true when you're doing programming—"If this is true, then this will happen." So I do a lot of hands-on hypothesizing in the science centers where they will look at something and "If this is true, then this will happen"...so they do those sorts of things that have nothing to do with the computer...then when we do the computer programming, I ask them to do the same thing and they have a real clear understanding of what that means and how many of the "thens" you can have in one particular statement. Using math is real obvious; teaching variables can be done in no other way as realistically as you can on the computer. So I do a lot of math programming.... And the reason I like the computer is that in no other way can you get the instant result. It's either right or it's not right....

Students in the Blue Cluster create animations in HyperCard in all subject areas. For example, as part of the Ocean curriculum, students create card field animations depicting marine creatures. In one animated sequence, various marine creatures rise out of a "Magic Box" after it has been clicked on. Clicking on the marine creature leads to the appearance of a box providing its name and additional factual information. Once students have learned the basic steps for producing an animation such as this, they can alter these steps to achieve different results. C.A. emphasizes the transfer and extension of what has been learned from one task to another as an important aspect of the problem-solving process.

The Planiverse Project is an ongoing activity that is conducted in collaboration with L.P.'s 5th-grade classroom in another city. C.A. and L.P., along with another teacher (S.J.), shared similar philosophies and approaches and were interested in working collaboratively. The project is based on a book written by A. K. Dewdney about a two-dimensional world. C.A. and S.J. had read the book and came up with the idea of using a simulation of a two-dimensional world as a multidisciplinary activity that would encompass writing, math, physics, and programming. The project lasts the duration of the school year; approximately two 45-minute periods each week are devoted to the activity. Working in collaborative groups within their classrooms, students solve a series of problems pertaining to the various aspects of life in a world where everything is flat: What do the creatures in this world look like? How do they move? ...eat? What do their homes and schools look like? Students discuss and debate their proposed solutions, arriving at diverse and creative approaches to the many problems posed. These discussions, sometimes accompanied by enactments to illustrate key points, are videotaped and exchanged between classrooms. Students also program animation sequences in HyperCard that simulate various aspects of the Planiverse. These HyperCard scripts are also shared between classrooms. Periodically, students in the two classrooms discuss their proposed solutions via e-mail. At several points during the school year, C.A. and L.P. each spent 2 to 3 days observing and teaching in one another's classrooms.

Throughout the project, students are challenged to justify their proposed solutions to others, and to work toward "some kind of agreement about what the world would be like." Many solutions lead to additional problems that must also be addressed. For example, after designing their creatures with eyes on the sides of their heads, students were asked to consider the problem of creatures raising their arms and finding themselves with their vision blocked. In addition to determining how creatures move their limbs and transport themselves from one location to another, the problem of how two creatures could pass one another in a two-dimensional world was posed. At times, students within the two classrooms have taken similar approaches to these questions. For example, both classrooms came up with underground living quarters and the passing rule that creatures moving west would have the right of way. In other instances, students have come up with a diverse range of solutions to a particular problem (e.g., using rockets, hinges, springs, suction, and other means of mobility). In the process of justifying their approaches to others, students learn to reconsider their own thinking and to accept that there is usually more than one right answer to any given question pertaining to the Planiverse. The animation programming adds another dimension to the problem-solving process and provides students with an opportunity to test out and to demonstrate their ideas, as well as to review and critique the ideas of others.

Once they had the creatures with all the specifications that they thought were necessary...we posed the question of, if you raised your arms why would you be in total darkness?...Well, that took a minute.... They also realized that if I need to pick something up, I need to have two of something on this side of my body. They drew this on the computer and after they had the creature put on the computer, then they had to solve the problem, if two creatures met on the planet how would they pass one another? They did come up with a rule; in both places the children came up with a similar rule...the person traveling to the west had the right of way. They had to do those animations.... We sent our stacks up to [L.P.'s class]...I had six groups working on it. The creatures do not look the same, and their ways of moving are different. They did all decide that they needed to live beneath the ground.... What they have learned and have decided to do they can actually animate and show me, and it's worth a million words. "When the two creatures come together, this is what happens"...to actually animate that and to show what the shelter looks like, to put the shelter up and to take the shelter down. It means more..., We can share it readily with someone else.

C.A. regards simulation and programming as powerful tools for developing the critical thinking skills of her students. She would like to expand her use of simulation into other activities and areas of the curriculum. She is currently working with a small group of programmers at Apple to develop a simulation based on the Planiverse project. During our site visit, she was planning to introduce a project in which the 4th and 5th graders would develop simple simulations for the 1st-grade children in the Green Cluster to explore. The idea is to have the older students program simulated "journeys" that incorporate their environmental studies (e.g., study of the ocean and underwater life), then act as tour guides for the younger students.

Along these lines, C.A. has developed a "Planet Ocean" simulation in which students go deep-sea exploring in a bathyscaph to collect video clips (accessed using laser disc) of underwater life. The simulation includes four progressively more difficult "missions," which must be conducted within a specified number of minutes in order to maintain oxygen levels given differing ocean depths. Students click on a control panel to hear the captain's instructions and to activate their underwater cameras. In addition to viewing and collecting the videotaped samples, students can click on a "research book" that provides text information to aid the identification and study of the featured marine creatures. The information gathered through this simulation activity (video clips and texts) is used by students as part of a larger research activity. Students are asked to incorporate the video and their findings into their final research presentations.

In addition to their HyperCard programming activities, students in the Blue Cluster engage in computer-supported graphic design using Canvas. Each month, students are given a list of "Mind Mover" questions and activities (one for each day of the month), ranging from riddles to trivia questions to mathematical problems to short creative writing assignments. Five of the activities are selected by the teachers as ones that all students must do, and an additional four or five of the activities are self-selected by the students. Beyond addressing each of the questions and assignments with an appropriate response, the goal for the students is to arrange all of the items on a single page in a graphically pleasing format. Students use Canvas as a design tool, carefully planning and rearranging their layouts until all of the items fit onto a single page. They use picture banks, borders, and various fonts to enhance the visual quality of their products. The completed Mind Movers are printed up and shared among the students. During the month of our site visit, Mind Mover activities included: answering riddles about leprechauns, naming two states that were shaped like rectangles, calculating the total number of toes and fingers in the Blue Cluster, and writing brief essays on the chewing of gum in school. Each student's Mind Mover page was a unique product, and most students were eager to share their past and present products with us, clearly taking pride in their work.

We use the Mind Movers as a way of teaching the kids what is good graphic design. And how they can actually complete something and have it look pleasing to the eye, have it be a completed task with everything that they are asked to do in it and yet be as creative as they want.... There is no one way of doing it and all the kids do them in a very different way. There are choices to it.... And they come out incredibly different. The point [of the activity] is can you make it graphically pleasing and complete the task on one sheet of paper, which you can always do if you are willing to do the planning and the preplanning and the layout...it's kind of like the computer is the place where you actually do what you have thought about prior to this. And if there are mistakes, there is no reluctance on their part to do them again.

Students in the Blue Cluster also use Canvas to explore mathematical principles and artistic design through the creation of tessellations. Students design geometric patterns that are then manipulated and repeated in such a way that each pattern fits into another, rendering a final product of embedded, recursive patterns. The computer provides a tool for producing the precise angles and shapes that are required in the construction of tessellations, increasing students' understanding of geometry in the process.

What the tessellation does is...you design what you cannot do as readily in any other medium. And you can copy and paste that over and over again, but a tessellation fits exactly into one another in these repeated patterns and it becomes this gorgeous piece of art in which you can flip it any way you want and how you flip it determines what you see inside of it.... So being able to show the kids what a repeated pattern looks like and how when they look at a piece of artwork what looks real simple may not be so simple. I use it in that way and I use it for...doing geometry, learning squares, triangles; how do you draw them; how do you make an octagon an exact octagon, so all of the angles are exactly the same?

Other technology-supported activities in the Blue Cluster include word processing and using CD-ROM and laser discs as information sources for independent and collaborative research projects.

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y	Microcomputers
Y	Word processing
N	ILS
N	Spreadsheet
Y	Other LANs
Y	Hypermedia
Y	WANs
Y	Animation
Y	CD-ROM
Y	Simulation
Y	Interactive videodisc
Y	Videocams and editing equipment
	Other

Note: .The classroom is equipped with 32 networked Macintosh computers, a laser printer, a scanner, a VCR, a video disc player, and video cameras. The primary applications in use are word processing (MacWrite), graphics software (Canvas), and HyperCard. Students and teachers have used AppleLink to connect and communicate with other sites. In 1994, the school was awarded a Chapter Two grant that will fund Internet access.

6.0 Technology Use *Classification and description of how technologies were used.*

- Student Uses **[*kiduse*]**

Tutorial ***[tutor]***

Not observed or described. Tutorial programs in general do not provide a good match with the Progressive School's constructivist philosophy and approach.

Exploratory ***[explore]***

Yes. HyperCard programming and the use of Canvas to create tessellations (repeated patterns) provide students with opportunities to explore mathematical concepts in a hands-on, experimental fashion. Students use HyperCard to put into play their ideas and theories about the two-dimensional worlds that they are constructing and "simulating" in the Planiverse project. Laser discs are used to explore aspects of marine life and U.S. history within the classroom's curricular theme-based studies. CD-ROM encyclopedias are also used for gathering and exploring information.

Communication ***[commtn]***

Yes. Students share their solutions to problems posed within the Planiverse project through e-mail discussions and through exchanging videotapes with another classroom. During the 1993 interview, C.A. spoke of plans to link classrooms "so that we can share what we are doing in real time." In an updated interview, she reported that "real-time" capabilities were cost prohibitive. However, the school received a grant from Pac Telesis to support the use of networking in classrooms. In addition to increasing the current bandwidth, the grant will provide additional support for teacher training and curriculum integration. Participating Progressive School teachers will meet at the beginning of the 1994-95 school year (in September) to plan their networking activities.

Tool ***[tool]***

The primary use of computers within C.A.'s classroom is as a tool. Primary tool uses are for writing (MacWrite), graphic design and calculation (Canvas), and programming (HyperCard). Computer-supported writing consists of editing and formatting texts as final products (first drafts are pencil written). Students learn graphic design in the context of preparing monthly "Mind Movers" in which four teacher-selected and five student-selected problems are organized and presented in a visually pleasing manner on a single page. Students engage in a variety of HyperCard programming activities, which are integrated with various aspects of the curriculum.

- Teacher Uses **[*tchuse*]**

Communication
Teachers at Progressive have used AppleLink to communicate with other teachers and with program developers at Apple.

Presentation
C.A. has a strong interest in HyperCard programming and has used her programming skills to develop instructional materials for her students. She has created a "Planet Ocean" simulation in which students go deep-sea exploring in a bathyscaph to collect video clips (using laser disc) of underwater life. The simulation includes four progressively more difficult "missions," which must be conducted within a specified number of minutes in order to maintain oxygen levels given differing ocean depths. In addition to viewing and collecting the videotapes, students can click on a "research book" that provides text information to aid the identification and study of the marine creatures. The information gathered through this simulation activity (video clips and texts) is used by students as part of a larger research activity. Students are asked to incorporate the video and their findings into their final research presentations.

C.A., in collaboration with the studios at an aquarium, has also developed a laser disc (using studio film) and simulation in which students can explore the survival skills of a fish or another form of marine life (e.g., searching for food, escaping predators, avoiding different potential disasters, etc.). The situations that students vicariously enact through the software vary in complexity, "depending on students' curiosity and their will to expand their knowledge."

C.A. uses laser discs to present information on the ocean and U.S. history. More often, students are given opportunities to explore this resource on their own, within the context of their research projects and presentations.

Instructional Management
No.

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration

  Yes. Collaborative learning is an overall goal and approach within C.A.'s classroom. Technology is viewed as providing a supportive context for collaborative activities.

- Independent exploration

  Yes. C.A. encourages her students to work both independently and collaboratively to explore information and concepts using technology.

- Access to outside information resources

  Yes. This is a goal that has not been fully realized, but it is in progress. C.A. states that she hopes to extend the use of telecommunications as a tool to provide students access to outside resources. During the 1993-94 school year, the school was in the process of installing a WAN with Internet access.

- Support for higher-level thinking

  Yes. C.A. states that she is a strong believer in teaching programming, primarily as a means for supporting problem-solving and critical thinking skills.

- Creativity

  Yes. C.A. has constructed a series of activities that call for creativity on the part of students. Within the Planiverse project and Mind Movers activities, for example, students are encouraged to come up with creative solutions to a series of problems.

- Technology skills

  Yes. This is clearly an important goal from C.A.'s perspective. She feels that technology introduction should begin early in order to better prepare students for the future. She is particularly concerned that students in her classroom have equal access to the computers and that all students, regardless of gender, experience success and develop technology understanding and expertise.

I think the kids are going to be living in a world filled with the technology... looking at learning and the availability of information that they will have at their fingertips that we never had in ours. How are they going to get through all of that? ...Teaching them to get on an encyclopedia and on line...how do they conduct a search.... Those skills need to be introduced at the level that we are starting, not waiting until they get into junior high or high school. They're being asked to do larger things...because if they don't know how to do it, when they're asked to do it, that's not going to help them get it done. We need to do it now, and the technology is a way like no other....

One of my bugaboos has been that computers have been sexually biased (more of a male thing). I think because I'm a female and I'm the one that is being a presenter and I'm the one that knows, that [this gender bias] does not exist in my class. I think that it breaks out even; the boys do not take over because the girls can do just as much. [Explains that she plans to use LEGO LOGO and that if the girls don't take to it, she will sit down and build with them....]

8.0 Realized Benefits of Technology ***[kidout]*** *Include any of the following:*

- Motivation ***[motiv]***
  Yes. C.A. feels that the activities that students are able to accomplish with the aid of technology, such as animation and creating tessellations, are very motivating. She believes that the computer provides a medium "like no other" for rendering immediate feedback and results, which is satisfying for students. She also believes that students are more motivated to revise their work at the computer, whether it is a HyperCard script or a graphic design or a text, given the feedback, the types of products they are able to create, and the ease with which alterations can be implemented. For children who may be unsuccessful in other arenas, the computer provides a different modality and means for success.

Kids like the immediate results. It's not a result that you can get anywhere else except on the computer.... When you can really make it happen, you've said more.... For them it is really a big deal. Much more so than I ever thought it was going to be. And you have a captive audience because you're using cartoons and animation and what kid doesn't like to watch cartoons?

I don't know if it's changed how I view kids so much as it's changed how I view learning. It's changed the children...especially those children who did not necessarily succeed in other avenues who are succeeding in this now. My favorite is this boy from a low-income family who had major problems at home. The kids that don't necessarily star can become the stars. He figured out a way to get the computer to make music by getting in and mucking around and getting the computer to play certain letters by certain powers and it changed the musical tone of the note and he actually wrote a piece. He stayed in every recess...when I asked him what he was working on, he wouldn't tell me. Then he asked if he could put his HyperCard stack on my computer because it was hooked up to speakers. I said sure, and at recess, the kids don't go out, they stay in to work (which is another positive outcome; this is by choice). So he put it on my computer and played his music and literally stopped the room. And for months he had kids begging him at recess, every recess, to teach them how to make the music. And for that particular kid it was the world, because he really was not successful academically and was having lots of problems.... This really changed him for that school year. Hopefully he will take that with him wherever he goes, but for that moment and for that amount of time that was his time. And I couldn't have done it...he might not have been able to find a medium where he could show me or show whomever that he could figure this out all by himself. And it was to make music, which is not something we would have thought of...it's HyperCard that gave us that so he could play the different pitches.... First he kept it to himself, he felt so good, then after he had enough of the accolades, then he was willing to share it. And he felt good about sharing it. So he got two things out of it, plus it was wonderful that he figured it out.

- Attendance, time on task, discipline ***[kidbehav]***
  Yes. C.A. reports that students have "a real good feeling about coming to school," a feeling that she attributes in part to their use of technology. She notes that discipline problems often result from not having meaningful, exciting projects to engage in. Technology contributes to the sense that "they always have something that is high powered to do, which is motivating."

- Amount of collaboration and cooperative learning skills ***[cooplg]***
  Yes. Students within the Blue Cluster often work in pairs or small groups at the computers. The products that they are able to produce at the computer (texts, animations) allow them to communicate their ideas readily to others. Within the Planiverse project, videotapes are used to extend their collaboration with another class. The tapes enable the students to share their problem-solving process (through taped segments of group discussions and debates regarding the features of their simulated two-dimensional world) as well as to present their proposed solutions through descriptions and enactments. C.A. would like to extend this aspect of collaboration through the use of live video over a computer network.

- Ability to manage own learning ***[selfreg]***
  Yes. C.A. feels that students' time-management skills are influenced indirectly by the use of technology. Students choose to stay in from recess and at lunchtime because they want to keep on working at the computers. Making these choices around their use of time is one aspect of their feeling in control of their own learning activities. More generally (beyond the use of technology), the program at the Progressive School supports self-regulation and direction.

- Access to outside information resources ***[outinfo]***
  Yes. C.A. states that the information that is now available to students "has become more comprehensive because of the technology that is available to us." She uses laser discs and CD-ROM to "actually bring that outside world to the classroom." Having these resources at their fingertips is viewed by C.A. as providing opportunities for students to "see the realities of what we are

talking about really quickly." Within the Planiverse project, students exchange and discuss their ideas with a collaborating classroom via AppleLink. A current goal that is in the early stages of implementation is to utilize resources available on the Internet for conducting research and for expanding access to outside resources.

- Support for higher-level thinking ***[higher]***
  Yes. C.A. feels that programming in particular supports a higher level of critical thinking and problem solving on the part of students. C.A. strives to reinforce the transfer of learning by having students go from a particular process or task off the computer (e.g., constructing "If...then..." statements regarding a hands on experiment), to doing the same process or task at the computer (e.g., incorporating "If...then..." statements into a HyperCard script) and in different ways (e.g., altering the script to program different animations).

  What they walk away with through programming...learning problem solving, how to sequence ideas, how to even go about saying in English (despite what the computer language is) what it is I want it to do and can I get from point A to point B? That organization of thought and that sequencing of ideas I think is absolutely important for everything they will do the rest of their lives.

- Complexity of task students can accomplish ***[taskacc]***
  Yes. C.A. feels that programming activities enable students to undertake tasks and gain exposure to concepts that would otherwise exceed their grasp. For example, students using Canvas to create tessellations are learning complex math concepts in the context of a hands-on, fun activity. The animation sequences that students create in HyperCard also involve the application of mathematical concepts and problem-solving skills that C.A. states are uniquely supported in this context. HyperCard programming of animation sequences within the Planiverse project enables students to address the logical, mathematical, and physical aspects of the problems in ways that would not otherwise be possible, as students are able to put their ideas into play, see the results of their theories, modify their solutions based on the immediate feedback they receive, and share their solutions more readily with others.

- Learning on specific tasks ***[kidlearn]***

  Yes. C.A. states that the computer eases and supports the revision process, allowing students to alter their products without the tedium of rewriting or redoing from scratch.

  It's kind of like the computer is the place where you actually do what you have thought about prior to this and if there are mistakes, there is no reluctance on their part to do them again. Over and over and over because it is so easy to do. Same thing with creative writing, they will continue to make their papers the best and they will reedit again and again and again because they don't have to rewrite all the time. It's just going in and correcting....

- Creativity ***[create]***

  Yes. Individual expression and creativity is valued and nurtured within the Progressive School, both on and off the computer. Within the Planiverse project, students use the computer to design and animate their unique versions of the creatures and the environments in a simulated two-dimensional world. Students engage in creative graphic design through the monthly "Mind Mover" activity, in which they lay out and illustrate a series of items (poems, solutions to problems, answers to riddles, etc.) on a single page. Students contribute their creative writing, edited and produced on the computer, to the monthly school newsletter.

  We use the Mind Movers as a way of teaching the kids what is good graphic design. And how they can actually complete something and have it look pleasing to the eye, have it be a completed task with everything that they are asked to do in it and yet be as creative as they want...there is no one way of doing it and all the kids do them in a very different way. There are choices to it.

- Greater attention to how a product will be understood by others ***[audience]***

  Yes. Within the Planiverse project, students are asked to present and justify their solutions to other students. Technology becomes a vehicle for sharing and representing one's argument in various ways (through programming animated sequences, through written text, through videotaped discussions and enactments). C.A. states that in the process of presenting their ideas using different modalities, students strive to make their solution as convincing and as "sense-making" to others as possible. In addition, they come to accept differing opinions and to understand that their are many different ways of approaching similar problems.

- Technology skills ***[hackskl]***

  Yes. The students in C.A.'s class have a high level of access to technology throughout the school year for a wide range of tasks. Many of the students at the 4th- and 5th-grade level have used computers as tools for writing, drawing, and other activities since from the time that they first entered the school. Consequently, students demonstrate a high level of proficiency and confidence with respect to their use of the computer.

Potential Difficulty: Attention to Format Rather Than Substance

C.A. believes that the computer is best used as a writing tool for final drafting and editing, rather than initial composition. She also feels that students may sometimes devote too much attention to formatting and machine-related functions, rather than to content, when writing at the computer. For this reason, she has her students compose initially with the pencil. Like other teachers we have interviewed, she is of the opinion that formatting options should be limited so that students focus more readily on substantive issues during composition. She feels that the computer's benefits as a writing tool are to be found in its support of the revision process (e.g., the ease with which alterations can be made) and the production of final texts.

For some kids, being on the computer to bang out your first copy is the absolute worst thing because they're really not thinking. They're more wrapped up in the typing, the speed of it, what font are they using; they are not thinking about the actual writing or what it is that they're trying to get on paper, what are their thoughts really about, 'is it clear?' They'll get in and they'll play with those fonts and they'll make them bigger and they'll make them smaller and that's not the point. It depends on what the assignment is, but most of the time we start with paper and pencil.... That is why I'm happy I *don't have color monitors, because they would muck around until that picture looked absolutely gorgeous, and it's going to print out in black and white. I can't justify that kind of time. That's not the purpose. The purpose is they can all have a quality piece that is laser-printer ready and it looks beautiful. It doesn't matter if my handwriting is sloppy or not sloppy, when it comes out of the printer, it's beautiful and I'm proud, which is really one of the most important things that I can see as far as what comes out of that computer for them.*

Final Note:
C.A. views the use of technology as an essential, fully integrated aspect of her instructional approach. It is hard for her to imagine her classroom without computers, as they have been incorporated into so many areas of the curriculum.

For me, if you took the computers out of the room it would be turning out the lights. I don't think we could ever go backwards.

SCHOOL OF THE FUTURE DEBRIEFING

Site: School of the Future

Contacts: K.W., Project Director
C.M., Lead Teacher

1.0 Summary [*sum*]

The School of the Future, a magnet middle school in a large midwestern city, was built on a philosophy of individualized instruction (a variety of instruction) with student choice of their personal learning goals and extensive attention to emotional and social as well as intellectual growth. At the same time, the School of the Future concept called for doing away with textbooks and using modern technologies to support teaching and learning. Use of out-of-school resources, such as museums, science centers, and internships at work sites, is another important component of the School of the Future's design. Students are organized into "advisories" that stay together during their School of the Future careers; most courses are open to the full age range of School of the Future students (9-14). The original staffing structure (used until 1993-94) called for a lead teacher (akin to a British headmaster) and three additional associate teachers who would form the "lead staff" responsible for student advising and curriculum development as well as teaching.

2.0 Context and Reform Overview

2.1 Educational Context [*context*]

Setting. This middle school occupies a building on the waterfront downtown. Formerly used as an athletic and social club, the building was totally renovated 4 years ago for use as a "school of the future" with input from teachers, students, and parents. The site features a variety of technology-supported learning spaces used for different purposes (e.g., cooperative learning areas, computer labs, classrooms equipped with Discourse Systems, an ILS lab, an independent study area, a video production studio). Every classroom is equipped with a telephone and a teaching station that includes a

Mac system (linked to a school student and staff network) and a video monitor to display in-school broadcasts or VCR or videodisc presentations. The building is simple on the outside, but inside is modem, attractive, and neat, but with an unusual lack of student artwork or other wall displays (except at student exhibition events).

The School of the Future's downtown location has enabled the school to offer a variety of off-site learning opportunities. For example, courses have been conducted at the science museum, the historical center, the state museum of art, and local cable-access studios. Students make regular visits to the public library. Mentorships and independent studies are arranged on an individual basis with local businesses, social service agencies, and artists.

Grade levels. The School of the Future began with grades 4-6, adding a grade each year so that it now encompasses grades 4-8.

2.2 Demographic Information [*demo*]

Applicable unit: School Class Project District Other.

Number of certified teachers (FTE): 9 (plus 4 for co-located TESOL program)

Enrollment as of 9/93: 170

Number or percent free or reduced lunch: 80%

Number or percent LEP or NEP: Not available; 100 TESOL students co-located

Number or percent special education: 8-9%

Ethnic Composition *(Number or percent in each category)*

African American	Hispanic	Caucasian, Non-Hispanic (Includes Native American)	Asian/Pacific Islander	Other
30%	9%	50%	11%	%

Estimated percent students w/ computers in home: 20%

2.3 Education Indicators [*stats*]

The school has not excelled in terms of traditional education indicators. Standardized test scores, especially in mathematics, showed declining performance relative to national norms over the School of the Future's first 2 years. The school took corrective action in the third year and students posted some gains in terms of standardized test scores. Many parents became nervous about the amount of freedom given to students and the failure to include certain elements in a required program. Despite the fact that initially there were 500 applicants for some 160 openings at the School of the Future, the school now has to actively recruit students (after much negative local press due to lowered standardized test scores). Many students and teachers left during the first few years. What the overall statistics do not show, however, is the set of students and parents for whom the nontraditional approach taken at Saturn was perceived as very motivating and successful. The staff and the district have taken steps to try to correct the problems they believe have led to such disappointing outcomes.

2.4 Reform History [*reform*]

- Nature and when started ***[history]***

  At the School of the Future, technology implementation and restructuring were expected to be mutually reinforcing factors in the school's original design. Built from the ground up as a "fundamental redesign of the way we deliver educational services," the School of the Future was founded by the city school district as a model for the coupling of technology use and educational reform. The school was billed in the early planning stages as a "high tech, high teach, high touch" program in which students would engage in a combination of computer-supported, teacher-led, and collaborative project-based learning activities.

  The idea for the creation of the School of the Future came from a keynote address, given by Al Shanker, President of the American Federation of Teachers, to the city's teachers and district administrators in 1986. During what one teacher later described as "a terrific and disturbing" speech, Shanker noted the failure of traditional education to prepare students for life in the 21st century. He called for the retooling of the public school system. Shanker's message struck a resonate chord with the city school administrator. He enticed the superintendent and other members of the city educational community to form a planning committee to explore the creation of a School of the Future.

The implementation of the School of the Future was a collaborative effort involving a series of local partnerships, grant awards, and corporate sponsorships. The School of the Future's project leader devoted much of his time during the 3-year planning period to soliciting and orchestrating the needed resources, funds, and equipment. The state Federation of Teachers, a local college, and an educational software developer and Apple Computer were among the initial and primary partners.

The School of the Future opened in temporary quarters in the fall of 1989 with grades 4 through 6 (grades 7 and 8 were added in 1990 and 1991, respectively). The school moved to its permanent location in a renovated downtown building in January of 1991. Although the magnet school enrollment process succeeded in establishing one of the most ethnically diverse student populations within the district (50% white, 50% minority groups), there has been a disproportionately high number of male students (65% or more) since the school's inception. School of the Future staff attribute this gender imbalance to the school's reputation within the community as a technology-oriented school, as well as to the fact that the school may be viewed as an alternative to traditional programs in which a greater number of male students are having academic difficulties.

One of the most unique aspects of the School of the Future has been its use of a differentiated staffing model, consisting of a project leader, a half-time principal, a lead teacher, three associate teachers, and, as school enrollment expanded, an increasing number of generalist teachers and educational assistants. An intern model was also incorporated for the first few years. For the first 4 years of the school's operation, the lead and associate teachers held year-round, higher-salaried positions and worked as a leadership team, responsible for the development and implementation of new approaches to curriculum, instruction, and assessment. The year-round positions provided critical time for planning and reflection. However, the two-tier staff structure proved to be problematic on a number of levels, resulting in fragmentation within the program, as well as increasing misperception and resentment on the part of other teachers within the district. For budgetary and other reasons, the school district discontinued the lead teaching positions, bringing the School of the Future staffing in closer alignment with the rest of the district at the close of the 1992-93 school year.

With the elimination of the year-round positions, the three remaining members of the original lead staff decided to transfer out of the School of the Future after 1992-93 as did several of the other teachers. Several individuals with approaches compatible with the School of the Future were identified, but delays in the district hiring process led them to re-commit to their previous positions, and the new teachers eventually hired for the School of the Future were largely inexperienced and did not come on board until 3-5 weeks after school had started. The school year began with long-term subs; the transition from them to the newly hired teachers was described as "chaotic and confusing."

For 1993-94, the Lead Teacher organized the staff into three teams, with the idea that they would plan multidisciplinary curricula. This did not happen; teachers complained that they did not have time for this kind of planning. As the school year was shortened, planning time became increasingly scarce.

Also during 1993-94, a TESOL program, developed to accommodate the influx of Southeast Asian families into the district, was brought into the School of the Future facility. The program includes 100 TESOL students, spanning grades 1-6, and shares administration with the School of the Future. School of the Future students can take courses offered by the TESOL program (e.g., music, physical education) in an arrangement they call "reverse mainstreaming." Older School of the Future students are trained as tutors and matched with younger TESOL students in a one-on-one tutoring program that is regarded as highly successful.

- Reform Features ***[feature]*** (check all that apply)

X Nongraded groupings
Extended periods
Schoolwide themes
X Teacher professionalization
X Authentic assessment
X Use of outside resources

- Key Individuals ***[key]***

The School of the Future's project leader, T.K. (formerly assistant director of student accounting and now director of technology for the school district), devoted much of his time during the 3-year planning period to developing the program and soliciting and orchestrating the needed resources, funds, and equipment. His work in developing the original vision was shared with W.J. (formerly at the district office and now with his own consulting firm specializing in student-centered instruction and school choice initiatives) and several other educational innovators.

The district superintendent during this period (D.B.) was described as a visionary and a big School of the Future supporter. He got the School of the Future initiative approved by the Board and protected the School of the Future from some of the administrative difficulties during its first 2 years, but then was replaced by a new superintendent who had less of a commitment to expanding the School of the Future.

C.M., the original lead teacher, served a kind of headmaster role in the School of the Future's first 3 years. He made it clear from the beginning that he did not intend to act as a principal, but he did want to lead the team of core ("associate") teachers in developing curriculum and creating the School of the Future's instructional philosophy. With a background in psychology and special education, C.M. places strong emphasis on understanding how students think and on individualizing instruction (a thrust shared with T.K. and with associate teacher J.B. who came from a speech therapy background). An articulate spokesperson, C.M. (like T.K.) has been active in writing articles and doing national presentations on the School of the Future and is now involved in consulting to the Edison Project and other national reform efforts.

- Funding sources for reform [***funds***]
  The district's general fund was the main source of support but there was considerable additional input from vendors and other corporations and from a foundation. In 1989-90 this outside support (including hardware and software donations) was estimated to top $450,000 in value.

- District involvement/support [***localref***]
  The impetus and funding for the School of the Future came from the school district. Nevertheless, in trying to get the school off the ground, the School of the Future staff found themselves repeatedly running up against district rules in areas such as the procurement of hardware and software and the use of travel funds. (District and state requirements regarding teacher qualifications and hiring practices had earlier prevented the hiring of lead staff with sufficient time before school opened.) While D.B. was superintendent, the school had some leverage in getting rules waived, but, according to the former lead teacher, district offices whose rules had been waived resented the School of the Future's actions and held them against the school later. In a newspaper editorial, Al Shanker used anecdotes C.M. had told him in writing about the School of the Future's experiences as an illustration of the difficulties a really innovative school has in a bureaucratic school district, further exacerbating the tension between the school and the district.

  Observers agree that the School of the Future would not have been established without the support not only of T.K. but of the district superintendent, D.B. D.B. supported the very innovative School of the Future concept, but he always expected the school to be able to prove itself in terms of measurable results (i.e., standardized test scores). Somehow this expectation of accountability in return for freedom to innovate was not emphasized with the School of the Future's lead staff during the early years, and when a new district superintendent took over and started looking at the School of the Future's unimpressive test scores, the relationship between the school and the district deteriorated rapidly.

After the 1992-93 school year the district took action to bring the School of the Future more in line with other schools in the city. The two-tier staffing organization was abolished, with all teachers serving 9-month contracts (the three remaining associate teachers left). The budget was cut for 1993-94, particularly in the areas of teacher salaries, teacher development, and technology. T.K. states that the per-pupil expenditures have been in line with other magnet schools over the last several years.

The district assistant superintendent for teaching and learning remarked that it seems ironic that the School of the Future is not officially a site-based management school, given their Parent Council and general philosophy. She speculated half-jokingly that maybe they just didn't want to complete the paperwork to become a site-managed school. She felt that this status would help the school a great deal in giving them more control over staffing and budgets.

By the time of our return visit in the spring of 1994, the School of the Future was having trouble maintaining an enrollment, and several blamed the district for using the School of the Future as a "dumping ground" for students who had failed to fit into other schools. There was the perception that the school had been given more than its share of behavioral problems to handle.

- State/federal involvement/support **[*stateref*]**
  The state provided a $100,000 grant to fund the initial software development for the pupil growth plans. The state appeared to have relatively little involvement with the innovations at the School of the Future and teachers did not refer to state initiatives or curriculum frameworks as influences on their instruction. State credentialing regulations did require a waiver before C.M. (who had only a special education credential) could be hired as lead teacher. The protracted discussions with the district and the union, as well as the Board of Education, contributed to a late start in hiring other teachers and planning the details of the School of the Future's program.

The School of the Future has not received Chapter 1 funds, but will become a Chapter 1 school in 1994-95.

- Role of tech in reform efforts **[*techref*]** *(classify and describe)*:

  X Part of initial reform concept
  Emerging part of reform efforts
  Parallel effort

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*]

Technology was expected to serve multiple purposes. Technology applications were seen as giving students tools for magnifying the kind of work they could do as well as preparing them for "tomorrow." At the same time, tutorial software (in the ILS lab) was conceived as a mechanism that would allow an instructional aide to monitor 60 students, giving teachers more time for individualized attention to students. Originally, teachers liked the idea of letting the system teach the basic skills while they focused on more creative, advanced topics. T.K. notes that the failure came in the ILS information not being used productively by the staff and the students.

3.2 When & How Application Started [*how*]

The school site features a variety of technology-supported learning spaces used for different purposes (e.g., cooperative learning areas, computer labs, classrooms equipped with Discourse Systems, an ILS Lab, an independent study area, a video production studio). Every classroom is equipped with a telephone and a teaching station that includes a Mac system (linked to a school network) and a video monitor to display in-school broadcasts, VCR, or videodisc presentations.

The availability and range of equipment at the School of the Future has been experienced by the faculty as a challenge that, while broadening teaching and learning opportunities, is sometimes overwhelming and has not been utilized at its full potential. Teachers were not on board when decisions regarding specific hardware and software choices were made. (The original plan to hire the lead teaching staff well in advance, providing the needed time to plan the program and to become familiar with the technology, did not occur due to hiring limitations [the requirements for the positions restricted the number of applicants], as well as other factors [e.g., the lack of a facility, equipment delays].)

In the words of one teacher, "this forced [the teaching staff] to have, use, and struggle with a technology that they might not have selected." Many of the teachers working at the School of the Future came to the school initially with little or no technological experience. Hired only six weeks prior to the opening of the school, the lead teaching staff was faced with a long list of priorities, such as developing the curriculum, organizing the schedule, and designing new approaches to monitoring and evaluating student progress. These critical issues, coupled with the daily responsibilities associated with teaching once the school was in session, took precedence over learning to use and integrate a variety of unfamiliar technologies.

As in many other schools, the mere presence of technology at the School of the Future did not ensure its immediate adoption and integrated use. The School of the Future teachers learned to use technology gradually, alongside their students. Additional technical training was provided through vendor-sponsored inservices, visits to other technology-supported programs, and participation in conferences and other professional development activities. A part-time technology consultant was hired in 1990, offering further support. The School of the Future teachers have been selective in their use of particular technologies and applications, making choices based upon their own individual preferences, as well as their perceptions of student needs and interests, rather than trying to incorporate all of the technologies available to them.

In some cases, teachers have had the opportunity to alter or reshape the technology to fit their approach. For example, one School of the Future teacher received vendor and district support in making modifications to the Discourse System which would allow her to use it as a tool for collaborative activities, such as group brainstorming. In other cases, the School of the Future teachers have found that they have needed to rethink and to alter their approaches to a particular technology. The utilization of the ILS lab at the

School of the Future provides a good illustration of this. Initially, the ILS lab functioned somewhat independently as the primary vehicle for the delivery of instruction in math and reading. ILS was referred to by the initial planning committee, whose decision it was to install the lab, as the school's "insurance policy" to ensure that students would receive exposure to and experience with the basic skills. Teachers, for the most part, took little interest in the ILS program, and some felt that it did not fit well with the overall philosophy of the school (i.e., learning skills within the context of meaningful tasks). ILS was never intended to operate as a stand alone, however, and ultimately the system failed to carry the weight of the curriculum that was placed on it. ILS continues to be utilized at the School of the Future, but it is used more selectively with particular students.

In the 1993-94 school year, to accommodate the TESOL students and the new teachers' preferences, most of the School of the Future's' space was converted to self-contained classrooms. The ILS lab, Discourse rooms, and Apple IIgs lab are used as regular classrooms for most of the day.

3.3 Technologies Used [*types*]

Y	Microcomputers (80 Macintoshes, including 21 teacher stations [Apple II gs])
Y	Word processing
Y	ILS (40 Jostens and 16 CCC Stations)
Y	Spreadsheet
Y	Other LANs (AppleTalk)
Y	Hypermedia
Y	WANs (limited) (12 Apple modems)
Y	Animation
Y	CD-ROM
N	Simulation
Y	Interactive videodisc (5 videodisc players)
Y	Videocams and editing equipment
Y	Other: Personal Growth Plan expert system, CAD software, scanners, laser printers

3.4 Target Grades & Curricula [*levels, curric*]

Technology is used at all grade levels and in all curriculum areas.

3.5 Key School Players [*infield*]

The School of the Future's teachers were not selected primarily for their facility with technology. Although quite a few teachers have developed comfort and facility with technology, no single teacher or core of teachers appears to be a leader in instructional uses of technology (i.e., to have influenced others and helped them develop skills). Over time, the experienced teachers appear to have become comfortable with technology tools, but we were told that newer, generalist teachers often are not. Associate teacher J.B. played an important part in working with the software development company on the Personal Growth Plan (PGP) software, She appeared to be the local expert on its functioning. The school has a part-time "network manager," who helps "keep the technology up to date and does equipment maintenance and ordering" on a consultant basis. Apparently the network manager is the only one who knows how to keep the local area network running. He does not appear to have much interaction with teachers on instructional issues. He expressed frustration over the fact that many teachers are not taking full advantage of the technology available to them. He said that he had once offered an after-school in-service on technology use, but no one came.

3.6 Outside Players in Technology Application [*outfield*]

- District involvement ***[distr]***

  The impetus and funding for the School of the Future School came from the school district. T.K. was instrumental in obtaining hardware and software donations from various vendors. On the other hand, the district did not provide a lot of hands-on support for teachers' development of technology skills. Further, in interviews, the former lead teacher cited frustration in dealing with a district bureaucracy that tied the school's hands in terms of buying software for their students.

- State involvement ***[state]***

  The state gave a $100,000 grant to fund the initial software development for the pupil growth plans.

- Business involvement ***[bus]***

  An educational software developer provided software and technical support and was responsible for an evaluation of the technology component of the program during the School of the Future's second year of operation. A wide range of corporate sponsors provided support (hardware, software) in the area of technology, including the Apple Computer Corporation, IBM, Tandy, Control Data Corporation, Pioneer, Cray, Jostens, CCC, Sunburst, and Optical Data. Control Data made the biggest contribution, an estimated $425,000 worth of PLATO software, an instructional management system, training services, and a file server and Omni system. Apple Computer donated an estimated $85,000 in equipment (25 Apple II/GSs, 5 Macintoshes, 5 Imagewriter printers, 2 laser printers, 12 modems, and an AppleTalk networking system).

- Foundation involvement ***[foundtn]***

  A foundation, which had been approached initially to supply additional funds for the school itself, funded a local college to conduct the formative evaluation of the School of the Future implementation.

- Parent involvement ***[parent]***

  Originally, there was a core of very enthusiastic, involved parents. As their students moved into higher grades and the School of the Future's problems unfolded, some parents got nervous and pulled out their children. Some seemed to feel that the School of the Future offered students too much choice; some were unhappy about the poor test scores; some wanted specific activities the School of the Future didn't offer (e.g., sports or foreign language).

  During the first few years, the school calendar contained additional days for planning and conferences. When that was reduced, a group of parents lobbied the district to get extra in-service days for the School of the Future teachers so that the individualized parent-student-teacher conferences to do the Pupil Growth Plans (PGPs) could be expanded to more than 20 minutes each. In the first few years, nearly all parents came to these conferences 3-4 times a year. Over time, conferences were held less frequently and parent involvement tapered off somewhat, although teachers still think that it is higher than at other schools. As new students came to the School of the Future, their parents have been less likely to understand and buy into the school's instructional philosophy.

On an end-of-the-year survey administered in June of 1992, responding parents were moderately positive (3.5 on a five point scale from 5 = Strongly Agree to 1= Strongly Disagree) about the School of the Future's progress in implementing this new school experience. In a survey administered the prior year, parents cited the School of the Future's focus on individuality and the availability of technology and learning resources as the school's major strengths. Lack of communication with parents about what students are actually learning, lack of consistent discipline, and too little stress on the basics were the most frequently mentioned criticisms.

Parents (and students) are included on school committees such as Curriculum and Cultural Diversity. The parent we interviewed in 1993 felt that the School of the Future staff listens to parents and try to make use of their talents. She felt that her friends like the School of the Future program but noted that they are among the well-educated parents; she said she didn't know how the School of the Future was perceived by parents with less education. She noted that 10-15 School of the Future parents have turned out for school board meetings when the School of the Future came up for discussion. Many of these parents had a story like hers of a child who did not do well in a regular school but had flourished at the School of the Future.

- Other outside influences, including research
  The local chapter of the Federation of Teachers was actively involved in the planning process and supported the contract revisions that were necessary in order to implement the School of the Future's unique leadership structure and year-round teaching positions.

A local college sponsored an internship program at the School of the Future during its first 3 years (the school chose to have four student interns rather than two additional certified teachers, a choice C.M. describes in retrospect as a mistake) and was awarded a 3-year grant by a foundation for a formative evaluation of the school. The reports, available in the case file, provide a wealth of detail about the School of the Future's implementation.

The educational software developer provided software and technical support and was responsible for an evaluation of the technology component of the program during the School of the Future's second year of operation.

4.0 Overview of Tech Uses

4.1 Student Uses [*kiduse*]

- Tutorial

Initially, the integrated learning system (ILS) lab functioned as the primary vehicle for the delivery of instruction in math and reading. ILS was referred to by the original planning committee, whose decision it was to install the lab, as the school's "insurance policy" to ensure that students would receive exposure to and experience with the basic skills. Teachers, for the most part, took little interest in the ILS program, and some felt that it did not fit well with the overall philosophy of the school (i.e., learning skills within the context of meaningful tasks). Ultimately the system failed to carry the weight of the curriculum that was placed on it.

The educational software developer's evaluation at the end of Year 2 reported that few School of the Future staff were knowledgeable about either the CCC or Jostens software and some felt that it emphasized basic facts out of context, an approach incompatible with the School of the Future philosophy. The vendors, on the other hand, disputed this characterization of their software and said that their materials were never meant to bear the full load of basic skills instruction and that School of the

Future teachers did not stay for the training they offered or show interest in really using the system correctly.

After 3 years, ILS continued to be used at the School of the Future, but it was used more selectively with particular students, and there was an attempt to more fully integrate it with other aspects of the curriculum (e.g., lessons were preprogrammed to coincide with math course activities). During the period we observed in 1993, a lab designed for 40 students was being used by six students. The parent we interviewed reported that neither the parents nor the students like the ILS. While most of the students in our focus groups had criticisms of the ILS software, there were several students who said they like learning in the lab.

By 1993-94, the lab space was used as a self-contained regular classroom for most of the day. The ILS was used mostly for TESOL students during that year. Plans were developed to change the platform supporting the Jostens and CCC systems from IBM to Macintosh and to redistribute the computers, placing them within advisory group classrooms, with the goal of getting ILS activities integrated with the regular curriculum. The redistribution was piloted with two classrooms in 1993-94.

- Exploratory
  Students can explore resources such as CD ROM version of Compton's Encyclopedia.

- Communication
  The School of the Future did little with telecommunications until the 1993-94 school year. Telecommunications were viewed previously as "a lot of trouble and not much payback." In 1994, network operating systems were upgraded and School of the Future students participated in the World School project, "Water Circle." Students gathered information on the local water system and exchanged it with students in other communities. In 1993-94, an Internet class was offered in which students exchanged e-mail and sometimes conducted research with pen pals across the country.

- Tool

  A primary goal within the School of the Future is to have students take responsibility for their own learning. Technology plays an important role in supporting this goal at a variety of levels. Students are encouraged to utilize technology to prepare and to present their projects and final products in the context of courses and self-directed learning activities. In the process of preparing a research project, for example, a student might xerox written material to highlight for later reference, gather information on CD ROM, conduct a telephone interview with an informant, prepare written text on the computer, and use the scanner, the interactive videodisc, or HyperCard to incorporate graphics, sound, or animation. At the School of the Future, students are given a great deal of flexibility in determining how they will go about their project work and which tools they will use in the process. This high level of self-selected access to such a wide array of equipment has resulted in what one School of the Future teacher has described as "technology hungry students" who are skilled and comfortable in their use of technology and who find ways to incorporate it into their work as a matter of course. A downside to this flexibility of access is that sometimes students become caught up in technology-oriented activities that are peripheral to their overall task (using valuable writing time to perfect the scanned image on the cover of a research report, for example).

4.2 Teacher Uses [*tchuse*].

- Communication

  Electronic mail is used internally to support communication among teachers. Teachers make announcements, share ideas, and express frustrations over e-mail on a regular basis.

- Presentation

  The Discourse System is designed to allow teachers to tailor their presentations to the level of individual students in the class. Students sit in front of consoles that allow them to input answers to teachers' questions. The system tallies the student responses and displays them for the teacher. The teacher can show the class the distribution of student answers, or can adjust the presentation to cover areas in which some students show a misunderstanding. Only a few School of the Future teachers ever used the Discourse rooms. One teacher had the software modified to support brainstorming activities; another used it in mathematics instruction. Most teachers were unfamiliar with the equipment due to inadequate inservice time.

- Instructional Management

  One of the most innovative uses of technology at the School of the Future was the development of a computer-based Personal Growth Planning (PGP) management system. The system was designed to allow teachers to use the system to create their syllabus, identify key process and product outcomes within courses, and monitor, evaluate, and report student progress. The concept was to have students engage in PGP in order to define their academic and personal goals, identify action plans and resources, monitor their own progress, and receive feedback from others. Student goals could be entered by the students themselves, with the support and assistance of their advisors and parents. Once a goal has been stated, the system uses a key word search strategy to assist the student in identifying relevant resources, courses, and mentorships. The system includes e-mail and reporting (hard copy) functions, supporting its use as a tool to facilitate communication between teachers, students, and parents. The development of the PGP system was a major undertaking. PGP software was created with the assistance of a local company specializing in the design of intelligent systems, and with support through a $100,000 grant from the state's office of educational leadership. In 1993-94, however, the system was rarely used. The new lead teacher said that bugs had not been worked out and teachers had not been trained. Also, the advisory sessions had been cut to 25 minutes, insufficient time for use of the system. Another source said that the software worked fine by itself but was incompatible with another application running on the network. Teachers continued to place their course information on the system but did not use the system to do individual planning with their advisees.

5.0 Implementation Details

5.1 Problems Encountered [*probs*]

- Difficulties in selecting hardware/software [*pick*]

  The hardware and software initially were selected by T.K. and a few others before the school opened. In some cases, it was not something the teachers (hired subsequently) would have ordered and was not a good match to their instructional philosophy. An associate teacher, J.B., reported getting some software modifications to allow use of the Discourse System technology for brainstorming sessions, a use far different from the tallying of student responses to closed-ended assessment questions envisioned by the technology designers. In 1992-93 only three teachers used the Discourse System. The ILS lab designed for 40 students was being used by six students during the period we observed. Further difficulties reportedly were district interference in teacher choices of software (according to C.M.) and what seems to be fairly thin support for teachers in selecting software (none of the teachers seems to have taken on this role; they do appear to receive much help from technology consultants).

- Difficulties obtaining hardware/software [*get*]

  The School of the Future opened without the technology in place because of delays in shipment. The PGP software was under development for 3 to 4 years (1992-93 was the first year it was operational and it still isn't finished). C.M. reported district interference with the School of the Future's obtaining software.

- Difficulties maintaining systems [*work*]

  Maintenance difficulties were not mentioned in teacher interviews. None were observed during the site visit. One of the students interviewed did mention frustration over the whole network going down when there is one bad cable.

- Theft/vandalism **[*crime*]**

  Students in one of the interviews said that their access to telecommunications networks had been limited because of computer vandalism. They referred to problems with students' using modems for hacking. Other students talked about students who had gotten others' passwords and trashed their files. In observed classes students showed concern about the security of their passwords.

- Teacher lack of knowledge/fear **[*block*]**

  Yes. Most of the teachers hired for the School of the Future came with little knowledge of technology, and a number resisted exploring the ways in which they could use it. Quite a few of the teachers who stay at the School of the Future have become comfortable with technology, but there seems to be general agreement that they have not had the knowledge to take full advantage of the resources available to them. One teacher was quoted as saying, "We have 300 software packages between the ILS, the Apple Lab and the Discourse, and we probably know two well. So we have 298 things we need to learn." A technology integration plan developed by the associate teacher for technology and the technology consultant during the School of the Future's third year pointed out needs in the area of teacher knowledge:

  - The School of the Future instructional staff must be aware of what resources are available.
  - Instructors must be made aware of how these resources can be integrated into the School of the Future's learning environment.
  - Instructors must become proficient in using a wider variety of the School of the Future's computer applications.
  - Technically complex resources must be made as "friendly" as possible for both students and instructors.
  - The School of the Future staff must be capable of providing technical support.

- Lack of time for learning to use technology or developing technology-related curriculum units **[*notime*]**

  Yes. In the third-year evaluation report, it was reported that teachers see lack of time as the critical factor preventing them from becoming familiar with more technologies and software. One teacher was quoted as saying, *"It's a time killer. We have these seminars every month or two and people just come in and 'wow' us at what our own equipment can do that we've never seen, but to learn it and be able to use it and then be able to know it and spend time programming—I haven't seen the great benefits of it yet—it's all time."* (p. 58)

The initial group of lead and associate teachers were hired very shortly before the School of the Future opened, minimizing their opportunity to have a voice in technology choices or the school design or to learn to use technology. Lead staff time to learn about uses of technology always competes with time needed for curriculum development, advising, and instruction.

When generalists were added to the teaching staff, they were given a general description of the School of the Future approach but no chance for extended guidance, supported practice or feedback either in the area of technology use or student-centered instruction. Reportedly, they were told that lead staff did not have time to work with them more closely.

- Disappointing results from using technology **[*letdown*]**
  At the School of the Future, the issue of standardized testing has posed serious difficulties. At the end of the 1990-91 school year, just one week after President Bush paid a high-profile visit to the School of the Future in honor of its "break the mold" efforts, falling student SRA Survey of Basic Skills test scores were leaked to the press. At the national level, Secretary of Education Lamar Alexander came to the school's defense, stating that "whenever people experiment, there will be failure...one of the problems with American education is everybody thinks everything has to be one hundred percent from the start." Locally, the news of falling test scores and ensuing negative press took a debilitating toll on the School of the Future, as community support declined and pressure from the district to treat SRA scores as "a bottom-line" measure of the success of the program mounted. The perception within the community that the School of the Future had received more than its share of limited district resources, during a period of severe budget cutbacks, only intensified the issue

(many were unaware of the level of external support given to the School of the Future). In addition, the concentrated infusion of technology and the school's investment in educational reform had set the stage for high expectations.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**
  In general, many felt that the ILS and the Discourse System were not good matches to the School of the Future's instructional approach. The Mac lab was seen as the most useful technology resource. In terms of specific curricular alignment, one of the associate teachers complained about the lack of available ILS software to match a middle school language arts curriculum.

- Lack of funds **[*nofunds*]**
  Funding was cut severely after the 1992-93 school year. In 1993-94, lack of funds for updated equipment and staff development was cited as a major impediment to improved use of telecommunications and other technology.

- Resentment from nonparticipating classes/schools **[*green*]**
  Resentments and local politics hurt the School of the Future. When the school did not do well in standardized testing, one of the local education editors began running highly critical articles questioning why all the extra resources were being spent on a school that wasn't even performing. (Many were not aware of the outside funds the School of the Future had solicited and perceived the school as having had an unfair share of the district education pot.) The sheer amount of technology housed at the School of the Future became a lightening rod for envy. In addition, there was speculation that one cause for the strength of this reaction was jealously over the relatively high salaries and the 12-month contracts of the lead staff. Another possible factor was animosity between the superintendent (who was associated with the School of the Future) and the school board and press.

- Lack of technical support **[*nohack*]**
  A report stated that several staff members felt that there was need for a designated staff member who could learn how to use and integrate various technologies and develop plans for their use within the School of the Future. Such a person could then provide on-site support for teachers trying to integrate technologies into their teaching and also make suggestions about useful software as courses are being developed. The School of the Future appears to have suffered from the lack of such a person who could help bring technology and instruction together; the purely technical problems seem to be handled by the network management consultant.

- Failure to see fast positive effects on test scores **[*noshow*]**
  Yes. The discussion below highlights the political fall-out from the poor showing of School of the Future students on standardized tests.

- Other **[*bug*]**
  Schisms within the staff caused serious problems from the School of the Future's first year. Lead staff expected to make decisions about approach and curriculum and wanted generalist staff to carry these decisions out without having participated in forming them. Generalist teachers felt that they performed the same functions as the lead staff and resented the extra pay and other "perks." Lead teachers did not appear to have the time and/or the inclination to work with generalist teachers to get their buy-in on the School of the Future's instructional philosophy or to help them develop skills in integrating technology into their curriculum and instruction.

5.2 Strategies for Overcoming Barriers [*solve*]

- Inservice training/release time
  The original plan called for 30 days of in-service time, but the implemented program had no where near that much. The associate teacher estimated that something like 9-10 days of inservice (once a month) were provided. Technical training was offered through vendor-sponsored inservices, visits to other technology-supported programs, and participation in conferences and other professional development activities. A part-time technology

consultant was hired in 1990, offering further support. These activities did not appear to be sufficient for many teachers, however. The technology consultant mentioned trying to offer an after-school in-service once but finding that nobody came. Such activities do not appear to have been a priority.

- Involvement of outside experts
  Organizational development consultants were brought in to assist with the resolution of conflict among the staff.

- Creative fund raising
  In developing the School of the Future plan, T.K. worked extensively with hardware and software vendors, local business, and at least one foundation to secure outside funds. Originally the foundation was approached to support the entire project; it chose not to do so but did support a 3-year evaluation.

- Other

5.3 Facilitators *[facil]*.

- Technical support on hardware/software ***[techta]***
  Technical training was provided through vendor-sponsored inservices, visits to other technology-supported programs, and participation in conferences and other professional development activities. A part-time technology consultant was hired in 1990, offering further support.

- Teaching skills (nontechnology) ***[haveskl]***
  Teachers were selected for skills other than technology use. Belief in the philosophy of personalizing instruction appeared to be a strong factor in hiring decisions.

- Technical assistance on integrating technology into instruction ***[instrta]***
  Teacher reports suggest that there was not enough of this kind of activity. Some teachers did have the opportunity to visit other technology-oriented programs and participate in conferences, but this appeared to be a fairly narrow group. A report stated that several staff members felt that there

was need for a designated staff member who could learn how to use and integrate various technologies and develop plans for their use within the School of the Future. Such a person could then provide on-site support for teachers trying to integrate technologies into their teaching and also make suggestions about useful software as courses are being developed.

- Supported time for teachers to develop skills ***[timesupp]***
  The School of the Future teachers had some extra release days but these seem to have been devoted to PGP sessions and curriculum development more than to developing facility with technology or technology-supported units.

- Other

5.4 Costs *[costs]*. *(Estimates in dollars or person months)*

The original project proposal to the foundation showed hardware costs of $1M in the first year, $750K in the second year, $100K in the third year, and $50K thereafter. Software development and procurement costs were pegged at $250K in the first year, $200K in the second year, $20K in the third year, and $10K thereafter. Staff development and intern selection and training were budgeted at $170K in the first year, $60K in the second, $40K in the third year, $30K in the fourth, and $20K thereafter. Actual costs incurred were much less for staff development (as there was little time available for training) but in the estimated range for hardware.

6.0 Impacts [*impact*]

6.1 Effects on Students [*kidout*]. *Include areas such as:*

- Motivation [***motiv***]
  For most School of the Future students, technology is a tool they want and expect to use. Students are annoyed if they have to share a computer with even one other student. They are impatient with slow computers or older, less powerful software. Students' liking for technology, however, varies considerably by use. In a student survey conducted by the evaluator during the School of the Future's third year, 70% said that using

the Macintosh computers made learning easier and more fun compared to 37% for the Discourse System, and 22% for the ILS. On an open-ended question that asked students to write in the best thing about the School of the Future, 47% mentioned technology

- Self-esteem **[*kidestm*]**
  The negative publicity about the School of the Future undermined the pride that kids felt in going there. Nevertheless, a number of students showed pride in their technology-based accomplishments.

- Attendance, retention, disciplinary rates **[*kidbehav*]**
  Attendance rates at the School of the Future have been high: 92.5% in Year 1, 95.6% in Year 2, and 96.5% in Year 3. The Year 1 evaluation report cited stories of students' eagerness to get back to the School of the Future on Monday mornings. Discipline was a problem in the first years of the school; the problem seems to have been addressed but the emergence of a policy and a strong acting lead teacher (G.C.) appeared to be a bigger factor than technology. The School of the Future has a 0% retention policy.

- Technology skills **[*hackskl*]**
  The School of the Future students are very adept in using a range of technology tools (word processing, hypermedia, CAD, etc.) and are free of anxiety about learning to use new software.

- Other
  The parent we interviewed stated that the School of the Future should probably never have been touted as the answer for all students, but that it had been a really good choice for her son and other students like him. Although this is one individual, her son's story illustrates the kind of niche this school can fill. She described her son (a seventh grader in his second year at the School of the Future at the time of the interview) as having had low self-esteem and lots of unhappiness at his previous school. There he had been bored by math and uninterested in learning multiplication tables; in language arts he was hampered by poor spelling and sloppy penmanship. At the School of the Future, the technology allowed him to get beyond such drawbacks and find new talents. With the computer, he

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could use a spell checker and a laser printer to produce attractive products, allowing him to concentrate on the substance and on being creative in his writing. The school's individual planning philosophy allowed him to try algebra even though he had not shown mastery of long division, multiplication, or decimals and fractions. As the mother said, "If he had stayed in a traditional school, he would have been suffering through 2 or 3 years of long division and multiplication. When he got here he decided he wanted to learn algebra. Instead of saying, 'No, you haven't got these other things done yet'...they said 'Okay, you can try it.' And he did, and in that process, he learned to do fractions and decimals quickly, because he needed to learn to do it to do algebra, which was his goal. So he started taking algebra last year and he is finishing up this year—and it's a high school algebra text. There's a whole classroom of these kids, some of them are fifth graders, doing high school algebra....He took another equations class as an elective....And this is the kid who didn't like arithmetic, and he just loves it!. . . He has math seven times a week! He thinks it's great!"

6.2 Effects on Teachers [*tchout*].

- Inclination to assign complex tasks ***[hardtask]***
  Not mentioned by teachers.

- New instructional strategies ***[tchstrat]***
  Not mentioned by teachers.

- Self-esteem and sense of professionalism ***[tchach]***
  The associate teacher heavily involved in working with the outside firm on developing the PGP software found this to be a very challenging and rewarding experience. The school staff participated in many national education reform activities including speaking at educational computer conferences (along with several students), the National School Boards of Education group at ITTE, the AFT QUEST conference, the Josten's Technology Conference, TIES, ATE (Association of Teacher Educators), and the state university's conference. The project director and lead teachers wrote articles for a number of national periodicals.

- Communication with other teachers ***[tchtalk]***
  Teachers have enhanced opportunities to communicate with each other about upcoming events, individual students, and ideas because of e-mail.

- Use of their time ***[timeuse]***
  Not mentioned.

6.3 Effects on School Climate and Processes [*schout*]

- Increased linkages with outside organizations, resources ***[link]***
  The School of the Future's use of technology has been part of what brought it national publicity and has led to increased opportunities for the School of the Future staff to participate in extra-district professional activities. The school staff participated in many national education reform activities including speaking at conferences (along with several students), the National School Boards of Education group at ITTE, the AFT QUEST conference, the Josten's Technology Conference, TIES, ATE (association of Teacher Educators), and the university's conference.

- Enhanced role as magnet ***[magnet]***
  Technology is one of the factors that attracts students to the School of the Future. Before the school opened, the district sent a description of it to families with children of appropriate ages and got 500 applicants for 160 initial spots. The School of the Future has had trouble attracting girls, however, and some have suggested that the technology image turns them off. As negative publicity increased, the lure of technology did not appear to be sufficient to attract a full complement of students to the school. By 1993-94, several respondents said that the School of the Future had become a "dumping ground" for students who had experienced problems at other schools.

6.4 External Accountability Measures and Their Influence [*account*]

At the School of the Future, the issue of standardized testing has posed serious difficulties. At the end of the 1990-91 school year, just one week after President Bush paid a high-profile visit to the School of the Future in honor of its "break the mold" efforts, falling student SRA test scores were reported to the press. At the national level, Secretary of Education Lamar Alexander came to the school's defense, stating that "whenever people experiment, there will be failure...one of the problems with American education is everybody thinks everything has to be one hundred percent from the start." Locally, the news of falling test scores and ensuing negative press took a debilitating toll on the School of the Future, as community support declined and pressure from the district to treat SRA scores as "a bottom-line" measure of the success of the program mounted. The perception within the community that the School of the Future had received more than its share of limited district resources, during a period of severe budget cutbacks, only intensified the issue (many were unaware of the level of external support given to the School of the Future). In addition, the concentrated infusion of technology and the school's investment in educational reform had set the stage for high expectations.

In retrospect, the teachers at the School of the Future felt that there were a number of steps that they could have taken that would have alleviated some of the difficulties they encountered. While teachers were exploring and experimenting with alternative methods of assessment, they neglected to keep the district informed of their important work in this area. They did not perceive, and therefore did not address, the value placed upon standardized testing at the district level. In their concentrated effort to get the program up and running, they also were unable to communicate their progress to the rest of the community. T.K. believes that the staff realized the importance of this, but lacked the "bully pulpit" to do it, especially in the shadow of the negative local press.

Although many staff remained skeptical about the legitimacy of standardized test scores as a measure of their students' learning, the School of the Future staff took a number of steps during the 1992-93 school year to try to improve their students' performance on the SRA tests. These included: hiring two teachers including a math specialist to work on the math curriculum, holding weekly meetings of the "math team" to plan and develop curricula, requiring every student to take a math course (rather than assuming that ILS plus the interdisciplinary approach would be adequate to cover math for those students who did not choose a math course), drilling students on math twice a week during the advisory period, having teachers learn how to use the Discourse

System to teach math, requiring all students to take a writing course, giving students test taking tips, and speaking positively about the SRA tests and their importance. The test scores in the spring of 1993 showed improvement, especially in Math Computation.

At the same time, the staff moved ahead on getting portfolio assessments in place and made a persuasive presentation of their work in this area at a May 1993 meeting of the school board. The board appeared to be favorably impressed with the School of the Future's work on portfolios, receptive to arguments about the mismatch between their goals and the standardized tests, and open to considering the possibility of giving the School of the Future a waiver on the mandated SRA testing.

In the spring of 1994, the principal said that test scores had improved "dramatically" but could not provide specifics.

6.5 Evaluation [*eval*]

- Test scores

  Students in the city take the SRA Basic Skills Survey in the fall and spring of each school year. The test data for 92 School of the Future students who took the test at all six examination points from the School of the Future's opening through the spring of 1992 are noted in a report. When the School of the Future opened, its students scored about a quarter of a standard deviation above the national norms for their grade levels on five measures (Comprehension, Reading Total, Math Concepts, Language Arts Total, and Composite). They were at the national norm for Math Total and about half a standard deviation behind in Computation (i.e., 42.31 on a standard score scale with a mean of 50). In the spring of the School of the Future's second year, the scores suggested that the School of the Future students had maintained their edge over national norms in reading and comprehension but had fallen about a quarter of a standard deviation on both the Math Total (from 51.54 to 46.55) and Computation (from 42.31 to 37.17). By the spring of 1992, these scores had risen (relative to national norms) somewhat to 50.25 and 43.55 for Math Total and Computation, respectively.

An independent evaluator's separate analyses for students in different ability ranges, although based on small numbers of students, suggest that the School of the Future experience tended to raise performance at least in math relative to national norms for lower-performing students while having a negligible or slightly depressing effect for above-average students. Given the lack of match between the School of the Future's curriculum and approach and the tests, the positive effects for lower-performing students are encouraging.

- Retention rates

  The school has a 0% retention policy.

- Attendance

  Attendance rates at the School of the Future have been high: 92.5% in Year 1, 95.6% in Year 2, and 96.5% in Year 3.

- Discipline rates

  Reportedly, discipline was a problem in the school's early years, but later settled down. The individualization logic behind the PGPs suggested that students with different emotional issues and goals might be expected to maintain different behavioral expectations. The unfortunate side effect was that there appeared to be no consistent behavioral standards nor clarity of responsibility for enforcing discipline. With more attention to the discipline issue and clarity about consistent rules, things improved somewhat in the School of the Future's third year, but by 1993-94 discipline again appeared to be a problem. Teachers appeared frustrated with and distrustful of students, either resorting to authoritarian methods of control or ignoring much of what was going on. Students carry slips of paper with them at all time. The slips are marked whenever there is a violation of a school rule, and three marks or the loss of a slip results in a suspension. Unsupervised students were observed getting into physical and verbal scuffles over who would use a particular computer.

- Teacher turnover

  Teacher turnover has been high and reflects the lack of community and shared purpose among the staff. During the first year, two paraprofessionals quit; in the second year many of the generalist teachers who came on were unhappy and left at the end of the year. At the end of the third year, the lead teacher took a leave of absence (from which he has not returned). At the end of the 1992-93 school year, the three remaining lead staff left when the two-tier staffing system was abolished.

7.0 Reflection and Advice

Several respondents, including the 1992-93 principal warned against trying to do so much so fast. Teachers were not prepared for the new roles they were expected to take within the School of the Future. The last-minute hiring of teachers (necessitated partly because they wanted to get the lead teacher on board first and it took a long time to secure a waiver for his hiring) led to a lack of consultation with teachers about the technology purchases and a lack of planning that hurt the School of the Future later. The two-tier staff policy, especially with the tendency to confine decision making and "perks" to the lead staff, appears to have been a serious mistake. In general, most informants felt that the lead staff gave too little consideration to building consensus about goals and methods within the school community and within the district. Some felt that the attempt to do without a principal (later compromising to a half-time district-imposed principal) was a mistake. Others felt that it wasn't so much lack of an individual with the principal's title as lack of attention to vital functions of district relations, clarifying of staff roles, discipline policy, etc.

7.1 Dissemination [*spread*]

The School of the Future planners and the lead teacher have published a number of articles in national journals and participated actively at conferences. The PGP approach and software used at the School of the Future are being looked at by several other city schools. Some of the ideas in the School of the Future prospectus have been picked up by subsequent innovative school programs within the district. T.K. has served as a national consultant on educational reform, sharing his views on what has been learned at the School of the Future.

The School of the Future was visited by over 2,000 visitors from around the world in 1991-92 and 600 in 1990-91. Visitors have included then-President

Bush and 140 members of the National School Board Association. The school staff have participated in many national education reform activities including speaking at conferences (along with several students), the National School Boards of Education group at ITTE, the AFT QUEST conference, the Josten's Technology Conference, TIES, ATE (association of Teacher Educators), and the university's conference. The project director and lead teachers write articles for a number of national periodicals. In subsequent years, the School of the Future made a conscious effort to curtail visits by outsiders in order to attend to pressing internal issues.

7.2 Plans [*plans*]

At the time of our return visit in the spring of 1994, the district had committed to supporting the School of the Future for another 2 years, but its fate beyond that point was uncertain. Staff appeared discouraged by funding cutbacks and the inability to fill staff vacancies in a timely manner and supply needed teacher training as well as the sense that the School of the Future was becoming a last resort for problem students. The original lead teacher and project director wrote a proposal to the district seeking continued support for the School of the Future and requesting:

Full-time principal who embraces the School of the Future's approach

Empowerment of the existing lead teacher to act as an instructional leader working closely with the principal

Appropriate staff interested in technology and alternative approaches

Ten-day extension of the school year to allow for Personal Growth Planning

Technology funding

Student selection process that would limit the proportion of at-risk students

Involvement of "constructive friends" to assist with public relations, technology, parent involvement, training, and curriculum development

Site-based governance

Strong and vocal support from the school board

On-site teacher development program

The district is making plans to implement a grades 1-6 program (Riverside Academy) at the School of the Future facility. The idea is that the academy would provide a feed-in to the School of the Future, aiding its enrollment. However, the district is leaning toward a more traditional school that would not provide a good match with the School of the Future's approach. The School Board has rejected several district proposals, stating that the program must provide a better match.

7.3 Advice [*advice*]

More than most of our sites, the School of the Future has involved different sets of individuals with widely divergent views about what has been learned and what could be done better. The recommendations below were those reported most often; where there were different opinions, it is so noted.

- Give more time for teacher involvement in planning.
- Involve teachers in the selection of technology.
- Place more emphasis on staff development and sharing.
- Select staff for their human relations as well as instructional skills.
- Select staff who are "with the program" and interested in innovation.
- Make sure that the district and school understand each other.
- A number of informants recommended implementing changes more incrementally; others did not.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title:	Mac Lab Uses Across the Middle School Curriculum
Teachers:	J.B., independent research class D.H., animation class G.C., architecture and design class J.W., Internet L.C., computer writing skills
Site:	School of the Future

1.0 Summary [*sum*]

The School of the Future is a magnet middle school in a large midwestern city, with a strong emphasis on individualized learning plans and technology-supported curriculum. The site features a variety of technology-supported learning spaces used for different purposes (e.g., an ILS lab, a Discourse lab, an Apple IIGS lab, a Mac Writing Lab, a Mac "multipurpose" lab, and a multimedia center). This description focuses on the utilization of the Macintosh Labs within a range of courses across the curriculum, including: Independent Student Research; HyperCard Animation; Architecture and Design; Back to Basics (practical writing skills); and An Introduction to Internet. With the exception of Independent Student Research (a required 8th grade course), each of these courses was offered as an independent elective and was open to all grade levels (4th through 8th).

2.0 Classroom Context [*context*]

The Mac Writing Lab and Mac Multipurpose Lab are used by a variety of teachers for different programs and projects across the curriculum. Course offerings change from term to term and are based largely on Personal Growth Plans and surveys to determine individual needs and interests. With the exception of the 8th grade student research class (a required course), all of the classes described are offered as electives and are open to all grade levels (4th through 8th). Courses meet for 50 minute periods on alternating days.

The Mac Writing Lab is equipped with 14 Macintosh computers, linked via a LAN to printers in other locations. A teacher's station includes a large screen for demonstration. The stations are placed side by side along the walls of the room. The Mac "multipurpose" lab is also equipped with 14 Macintosh computers, arranged in clusters at tables in the middle of the room and side by side along the classroom walls.

Three of the described courses were observed during the 1992-93 school year: Animation, Architecture & Design, and Student Research. The instructor for each of these courses was interviewed, providing an overview of the course and further information regarding teacher goals, perceptions regarding the role of technology and related benefits, and other background information. During the 1993-94 school year, two additional classes were observed: Introduction to the Internet and Back to Basics. Descriptions of these courses are based upon single class observations and teachers were not interviewed.

3.0 Reform Features [*feature*]

Y&N	Interdisciplinary
Y&N	Project-based
N	Collaborative Learning
Y	Mixed Age
Y&N	Extended Activity
N	Part of Core Program
Y	Teacher as Coach

Notes:

Interdisciplinary/Project Based/Extended Activity/Core Program. Technology use was central to each of the courses described and in this sense, it was part of the core program. Courses functioned independently of one another, however, and were not integrated in terms of a cross-disciplinary, overall project approach. The 50 minute periods limited the extent to which courses were project-based and "extended." Most of the activities observed were short term assignments that could be accomplished within several sessions. An exception was the Independent Research class, which involved research projects that lasted the duration of the term. The range of student selected topics included interdisciplinary subjects (e.g., science, social studies, history). Student projects in the Architecture & Design and the HyperCard Animation classes were interdisciplinary (involving math, writing, computer-related skills) and involved student projects that continued through the term. Several of the courses described focus primarily on writing skills (Internet communication; practical writing skills) and were not integrated with other subject areas.

Collaborative Learning. Most of the projects and courses observed did not appear to involve collaborative learning activities. Students interviewed described the sharing of files as being undesirable because of the high risk of having their passwords made known and their work destroyed by other students. This ongoing risk appeared to severely limit the collaboration that might otherwise occur at computers. In several courses, there were more students than available computers; in most cases students waited for their individual turns rather than sharing a computer with another student.

Several exceptions to this general observation were noted, however. Within the Internet class, a pair of girls worked together at a computer, exchanging messages with a pair of students (also best friends) in another school. In the Animation and Architecture and Design courses, students worked in parallel, periodically assisting one another with machine-related procedures and monitoring one another's progress. In these classes, collaboration was explicitly encouraged and at times structured by the instructors. In addition, the visual aspect of animated sequences and graphic layouts and designs appeared to attract students' attention to and involvement in one another's work.

Mixed Age. Most School of the Future courses were offered as electives to all grade levels (4th through 8th). The 8th grade Independent Research course was one of the few that was required and limited to a single grade level.

Teacher as Coach. Teachers acted as coaches within most of the courses observed. Classes often began with a brief teacher presentation focusing on the assignment for the session or reviewing the current goals and activities within a project. Teacher-directed mini-lessons were given on specific skills required at the current point within a project or assignment. The majority of the class time was devoted to independent work at computers, with the teacher circulating the lab to monitor individual student progress, and to offer assistance where needed.

4.0 Description of Activity [*activity*]

The classes observed differed in terms of their curricular focus and the types of student activities that occurred. A brief description of each of the observed Lab classes follows. 1992-93 course descriptions are based upon student and teacher interviews, as well as multiple classroom observations. 1993-94 course descriptions are each based upon a single classroom observation.

Independent Student Research. The 8th grade Independent Research course was taught by J.B. (Associate Teacher, Communications). It was a required course for all 8th grade School of the Future students ("students must demonstrate proficiency in the preparation of a formal research paper...") The course consisted of four to five sessions of teacher-led demonstrations (beginning with an overview of the research process, followed by sessions on specific aspects, such as how to write references), with the majority and remainder of the time devoted to individual student work and ongoing teacher conferencing and feedback. Stages of the writing process included: determining a topic, gathering information, note-taking and synthesizing, drafting, revising, and preparing a final product.

Previous student selected research topics have covered a wide variety of subject areas, reflecting an individualized range of interests – from sea turtles to cartoon art to the NSP controversy (Indian tribes protest of spent fuel rods on their land) to "the sense of violin playing from a personal perspective." Students were required to gather information from a minimum of three different sources. In addition to books and personal interviews, technology-supported sources, such as CD-ROM, videotape, and videodisc (available in the school's multimedia lab) were utilized. Note-taking and graphic documentation were also aided by technology as students used Xerox machines and scanners to copy and highlight selected material. Once all of the data had been gathered, students were asked to put all of their notes away and to begin writing in their own words. This approach was used in order to discourage students from simply copying or paraphrasing their notes. Students were given the choice of preparing their first drafts by hand or at the computer. Most students composed directly at the word processor, given the ease of editing and the requirement that the final draft be prepared in this format. Throughout the writing process, the associate teacher of communications conferenced with individual students, reviewing their drafts and providing specific feedback and instruction. Writing took place at the word processors in the two Mac Labs. The multipurpose lab, which included color Macs and graphics software, was used for final publication and formatting. Final products were to be shared in a student exhibition and will be included in students' "exit portfolios."

At the point of our observations, most students were revising their handwritten or word processed first drafts. A smaller number of students were working on their second drafts at computers, building in the required components with the guidance of their instructor. At the beginning of each class period, students discussed their goals for the session. Students who were working on their drafts remained in the Mac Writing Lab. Those who needed to use the Multipurpose Mac Lab or the Media Lab (to write, to work on graphics, or to gather additional information) were given passes.

Within the Writing Lab, students wrote at computers as the associate teacher rotated among them, providing assistance with computer-related procedures, formal conventions, and topic development. During one student conference, she reviewed the steps associated with citing references (e.g., last name first, double space, include city and state, APA format), walking the student through the process and providing word processing tips along the way (e.g., cut and paste, rather than delete and retype). During another student conference, she coached a student through the process of identifying the most important points that he hoped to communicate to a reader in his report on baseball. She instructed him to include these in his introduction, then assisted him with the ordering of his presentation of the material. She pointed out areas where clearer transitions and further breakdown of information were needed. This conference ended with positive feedback regarding the topic, and a caution to the student to consider the time frame in relation to the ambitious range of subtopics that he wished to cover within his report. Student conferencing appeared to be aided by the use of the computer, as both the student and the teacher could easily view the text on screen and recommended changes could be made immediately, with the teacher looking on and coaching throughout the process.

In the Multipurpose Mac Lab, students were working independently on various aspects of their projects. One male student was scanning images of satellites for his report on NASA. Another male student was working on a series of figures to use within his report on the probabilities of winning in gambling. Another male student spent the entire session working with *SuperPaint,* altering the color and size of the pixels for the graphics on the cover of his report (which had not yet been written). A fourth student was transcribing his handwritten initial draft at the computer. He commented that for him, composing was easier with the pencil because "you can get it down faster" and "you don't gotta (sic) do all this stuff" (referring to computer procedures).

HyperCard Animation. The Animation course was taught by D.H. (Associate Teacher). D.H. described the course as "completely technology-based" and "one of the most successful uses of technology" that he had observed with students. Previous to this course, D.H. began using HyperCard with students in a course on HyperCard Geography. Students created their own HyperCard stacks and in the process of experimenting discovered that they could do animation by putting a series of cards together. D.H. requested animation software and was given *Animation Works*, which was the software being used in the animation course. He did not have a chance to research the alternatives and had not worked with *Animation Works* prior to the course. After working with both applications, he felt that HyperCard challenged students more. His goal in the course was to facilitate creativity and a range of higher-order thinking skills that go into manipulating the technology.

At the beginning of the course, D.H. provided students with an overview of the "ins and outs" of the software. He then gave them time "to experiment, play around, and learn from one another." The course was centered on individual and collaborative student work, interspersed with occasional teacher-directed mini-lessons focusing on specific features and functions within *Animation Works*. The students were given three assignments (to complete in any order): (1) use existing characters and backgrounds to create a film; (2) create a title sequence using graphics and text elements; (3) use the cell editor function to create an animated character to put in a film of their own. D.H. prepared us for our classroom observation with the statement that we would see "some blusters and some bravado," along with observing students using the technology and one another as resources.

During our observations, students (all male) worked independently and often collaboratively on a variety of animation projects, including bouncing balls, flying and crashing machines, orbiting moons, superheroes in action, and sports events (e.g., snow boarding, skate boarding). One pair of students was selecting images to digitize from videotape to create an animation on snowboarding. Another student was problem solving an animation sequence depicting a bouncing ball. At one point, D.H. assisted him with various aspects of the sequence (How many balls? Where do you want it to start/end? Do you want it to accelerate?) A third student was creating the character and designing the background for his animation. Throughout the session, students took an active interest in one another's work, looking on as animated sequences unfolded on screen, and providing one another with positive feedback ("Cool!") and assistance.

Architecture & Design. The Architecture and Design course was taught by G.C. (Interim Lead Teacher in 1992-93). The course was based on a curriculum developed by *Interact*. At the onset of the course, the class was transformed into "a simulated community." Students were assigned an income and profession, then were given the task of designing, building and furnishing their homes within a given budget. Teacher-directed lessons focused on providing students with the basic skills associated with calculating area, scaling objects up and down, and creating floor plans. Students worked in groups for much of the initial planning, although each student was to create an individual product. Projects varied, depending on the interests and ability levels of the students. More advanced students were asked to do level elevations and final renderings of what their houses would actually look like (including landscaping).

The course was multidisciplinary, involving art, math, and social studies. The interim lead teacher felt that her background in the visual arts made her especially comfortable with the interdisciplinary project approach. The interim lead teacher commented that she was attracted to the curriculum because it provided students with an opportunity "to use math in the context of an activity that is integrated with real life." Math was involved in most phases of the design process (*"Some students can figure out the area of a rectangle, for example, but have real difficulty figuring out conceptually how to do this in relation to home design"*). Math also came into play as students worked within their loan amounts to budget materials (materials costs were provided in the pre-packaged curriculum that supports this course). The interim lead teacher brought in the math teacher as a consultant for particularly complex problems (e.g., when a student needed to figure out the area of a dollar sign-shaped swimming pool). Handwritten budget worksheets, rather than computer-based spreadsheets, were used. In addition to the math components, the interim lead teacher commented that "*There is also the artistic, aesthetic element,* *the development of drawing skills, and the chance for students to interpret their vision and use creative and higher order thinking skills. Students also learn about different types of homes "* (e.g., single family, multiple story, mobile homes), as well as about the relationship between personal economics and lifestyle. The interim lead teacher's assessment of student work was to be based on the use of math skills, the different stages of the design process (planning, preparing, creating, product), and creativity criteria. Final products were two-dimensional renderings created in the Mac Lab with home design software. The complete simulation lasted the duration of the term (26 sessions).

At the time of our observations, some of the more advanced students were working in the Mac Lab, using the home design software to create and furnish the layouts for their homes. An instructional assistant worked with students as they problem solved various aspects of the design process. Many of the students were scaling items of furniture (available in a menu within the program) and placing these items within various rooms. Two students were attempting to create arches, with some difficulty ("There's gotta be a way you can do this") until aided by the instructional assistant. Throughout the observed sessions, students engaged in ongoing dialogue with one another about their emerging plans, often pausing to observe or assist one another's progress.

Introduction to the Internet. The Internet course was taught by J.W. (one of the new teachers hired at the start of the 1993-94 school year). The course was designed to introduce students to the use of the Internet for personal communication. Students selected pen pals from across the country and exchanged e-mail during class sessions.

During the observed Internet class, there were 22 students in attendance. Several students worked on pencil/paper tasks while waiting for individual access to the 14 available computers. Two students observed others who were working at computers, reading their e-mail and making comments and suggestions. Several students commented that they did not have anything to do because they had not received responses from their pen pals. The Internet teacher commented that this is an ongoing issue, given that students in other schools often have more limited access to technology and are not able to respond as frequently as School of the

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Future students. He was trying to address this problem by identifying additional pen pals for each of his students to exchange e-mail with.

During the session, students working at computers were busily entering and responding to e-mail messages. Two girls were writing a lengthy message to two other female students, who were also best friends, in another state. They were exchanging information about the boys within their schools. One 8th grade boy was designing a chess set that would enable him to play chess with another student in Nova Scotia. In his e-mail text he wrote, "I do not talk to people well. So this is how I can communicate easily....Would you like to play chess with me? I've thought about it a lot and I have thought of a way to play over the vast gap between us using Internet..." This student was very focused on this project, which he continued to work on during the following class. Another, younger student (boy) responded to his Nashville pen pal's request for information about his school: "Our school is not really the school of tomorrow. It seems like the school of yesterday."

The use of telecommunications was new to the School of the Future as of the 1993-94 year (previously viewed as "a lot of trouble and not much pay back" according to the school's technology coordinator). Network operating systems are currently in the process of being upgraded. The school has participated in a World School project, Water Circle, where students are gathering information on the local water system and exchanging it with students in other communities. This is an area where the technology consultant would like to provide further training and support greater use (expand access to outside resources). Teacher training time is limited and not all teachers are interested in building on their uses of technology, however.

Back to Basics. Back to Basics, a course focusing on practical computer writing skills (e.g., resumes, business letters), was taught by L.C. (also new to the School of the Future in 1993-94). In the observed class, students were being instructed in and guided through the process of writing business letters. The class took place in the Mac Writing Lab, with 14 computers (22 students). A small group of students left to work in the other Mac Lab, given the shortage of computers. Many of the students were older and were adept at using the computers for writing. The class began with an overview of how a business letter should be formatted, labeling of the parts of the letter, etc. The computer writing skills teacher then instructed the students to write a letter to a business about anything they wanted. The letters were to be completed, if possible, by the end of the 50 minute session. Several students had initial difficulty coming up with ideas for businesses and for the content of their letters. The computer writing skills teacher encouraged them to "just make it up" emphasizing that this was an exercise in learning a particular format, rather than a focus on developing specific content. As students wrote their letters (ranging from complaints regarding faulty products to repair requests and solicitations), the computer writing skills teacher circulated the room and provided assistance as needed.

5.0 Technologies Involved [*types*]:

Y	Microcomputers
S	Word processing
N	ILS
N	Spreadsheet
Y	Other LANs
N	Hypermedia
S	WANs
S	Animation
S	CD-ROM
N	Simulation
S	Interactive videodisc
N	Videocams and editing equipment
	Other

S = some courses (see note below)

Note: WAN - students within Introduction to the Internet course used the WAN to link with pen pals over the Internet. CD-ROM & Videodisc - Students in Independent Research use these technologies as information sources. Animation - HyperCard and *Animation Works* are used within the course on Animation. Word Processing - Word processing is the primary use of computers within all writing courses (Composition, Research, Back to Basics).

6.0 Technology Use

- Student Uses [***kiduse***]

Tutorial ***[tutor]***

Tutorial software was not used within any of the Mac Lab courses described.

Exploratory ***[explore]***

Not observed in these classes.

Communication ***[commtn]***

The Internet course was designed to introduce students to the use of e-mail for personal communication. Students exchanged messages with pen pals in classrooms across the country.

The use of telecommunications was new to the School of the Future as of the 1993-94 year (previously viewed as "a lot of trouble and not much pay back" according to the school's technology coordinator). Network operating systems are currently in the process of being upgraded. The school has participated in a World School project, Water Circle, where students are gathering information on the local water system and exchanging it with students in other communities. This is an area where the technology consultant would like to provide further training and support greater use (expand access to outside resources). Teacher training time is limited and not all teachers are interested in building on their uses of technology, however.

Tool ***[tool]***

The primary use of the computers within the Mac Labs has been as tools for writing and other aspects of project work (graphics, scanned images, animation). Within the Research and Back to Basics courses, students created their written products on word processors, editing their drafts and publishing their final copies to share with others. Software within the Animation course (*Animation Works*) and within the Architecture & Design course (a home design program) was used by students to design products.

- Teacher Uses [***tchuse***]

Communication

Teachers communicated with one another via e-mail, primarily to share information regarding student progress.

Presentation

Not mentioned or observed.

Instructional Management

During the 1992-93 school year, students engaged in Personal Growth Planning at the computer. See school-level debriefing form for description. This system was not utilized during the 1993-94, given the influx of new teachers who were not familiar with the program and had not received training in its use.

7.0 Intended Benefits of Technology Use [*bene*]

- Peer-to-peer collaboration

  Yes for Animation and Architecture & Design. Within these two courses, collaboration was explicitly supported as an important component of the problem solving process.

- Independent exploration

  Yes for all courses. The School of the Future places a strong emphasis on students taking responsibility for their own learning process.

- Access to outside information resources

  Yes for Internet only. The course was designed to link students with other students in classrooms across the country, for the purpose of exchanging personal information via e-mail. Other projects have utilized the Internet for access to information resources within the context of research.

- Support for higher-level thinking

  Several of the School of the Future teachers mentioned this as a goal within their courses. D.H. felt that animation was an opportunity for students to engage in complex problem solving. The interim lead teacher stated that the technology component of the Architecture & Design students would allow students to develop more complex projects than would otherwise be possible, due to the problem solving focus on the use of the computer as a design tool. The Research course is designed to involve students in a high-level research and composition project that is supported through all phases by the use of technology (info gathering, note taking, writing, editing, and publishing).

- Creativity
  The interim lead teacher (G.C.) and the associate teacher (D.H.) each stated that creativity was an important goal within their respective courses in Animation and Architecture & Design. The computers were viewed as the tool that allowed students to explore and develop their ideas.
- Technology skills
  This appeared to be an implicit goal within all the Mac Lab courses, given the key role of technology within each. D.H. stated that it was his intention to raise students' comfort levels with respect to their use of technology. *When similar problems come up again, they will know that they have the tools to problem solve it and they won't be daunted (for example, "I know that I saw this revert menu in Animation and I think that it works something like this.") They learn to use technology as a tool....*

8.0 Realized Benefits of Technology [*kidout*]

- Motivation ***[motiv]***
  In a student survey conducted during a previous year, 70% of the students stated that the Macintosh computers made learning easier and more fun, making this the most highly rated use of technology within the School of the Future program. Students expressed similar sentiments during our visitations. Many student commented that the use of computers both eased and extended their learning activities, making some aspects of tasks (such as editing and copying notes) less boring and tedious, while also allowing and enabling them to accomplish things that they might not otherwise be able to achieve (e.g., creating HyperCard animation stacks, producing professional looking papers). The notion that they were using tools that are associated with the real (as well as future) world of work seemed important to many students.

  Students in the associate teacher of communication's Independent Research class discussed some of the motivating features of technology use within the context of conducting their research projects. Various technology-supported aspects of written composition and the research process were highlighted, including easier note taking (*It's easier than books, because you can select what you want, import it onto your file, take what you want and read and write it—doesn't require any paper* *work...It's just all in your mind*), editing (quote below), the ability to save products on the computer (*"storing all those stories instead of carrying around all that paper." "You can type anything you want, save it and it will always be there"*), graphics capabilities (*"If we didn't have the technology [instead of scanning] we would be Xeroxing and coloring with crayons or markers. It would be looking all different"*) and the professional appearance of the final product (*"If you're doing something like 8th grade research, you want it to look nice. You don't want childish sloppy writing."*)

Ease of editing at computer: *It's easier if you wrote it on the computer because you can have your draft and then if you decide that this part shouldn't go here, it should go there, you can just take it and cut it and...paste it and things and then you won't have to rewrite the whole paper. If you need to edit it or the teacher gives you suggestions like you're doing a report on a book or something...and she says maybe you should add this type of thing, then you don't have to go and erase the whole bottom part of the paper or whatever...you can just put the mouse there and write it in.*

- Attendance, time on task, discipline ***[kidbehav]***
  Not mentioned as a benefit. In most Lab classes, students working at computers were observed to be on task.

- Amount of collaboration & cooperative learning skills ***[cooplg]***
  Collaboration was not a strong component within most of the observed classes. In some cases, students working side by side at computers were observed to take an interest in and assist with one another's work. In general, however, students worked independently "in parallel" on their individual assignments and projects. Most of the students interviewed reported that they do not work collaboratively with others; several commented that they "had not thought about it." Many students expressed concern that sharing file passwords would enable other students to destroy their files (an ongoing problem at the School of the Future). Within two courses (Animation and Architecture & Design) collaboration was explicitly encouraged by the instructors. Students in the Animation course reported that they worked together on animation projects, but "not on other things." One student in this course commented that he preferred working with other students because "we get more information and we work faster and it's fun."

- Ability to manage own learning ***[selfreg]***

  The School of the Future places a strong emphasis on students' taking responsibility for their learning. During the 1992-93 school year, the use of a Personal Growth Planning software system played a key role in students' planning, managing, and monitoring of their individual goals and progress (described in school debriefing form). In terms of the Mac Labs, several teachers commented that the use of technology within their courses facilitated self-regulation, as students were able to take greater control over various aspects of their work at the computer. For example, the computer allowed students to edit or alter their texts, animation sequences, and architectural designs quickly and easily. The results of their alterations were immediately and seamlessly displayed, allowing for further shaping and revision. This high level of interactive feedback provided students with an important tool for managing their own processes and products.

  The associate teacher of communications commented that the use of word processors enabled students to respond to criticism better. *"They are able to make changes more easily and in a reasonable amount of time. This makes them more responsive to the suggestions of students and teacher."*

- Access to outside information resources ***[outinfo]***

  This aspect of technology use was not observed. Within the Independent Research course, students were required to utilize at least three information sources. Many students included CD-ROM and videodisc use on their information searches; access to the Internet or other technology supported off-site sources were not observed. Within the Internet course, students exchanged personal information with pen pals across the country.

- Support for higher-level thinking ***[higher]***

  Animation: D.H. commented that he has seen sophisticated kinds of problem solving and creative thinking that have to do with manipulating the software, as opposed to figuring out how to create an image. D.H. described a two-level problem solving process: the first level involving the manipulation of images or stories, and the second level having to do with meta issues, such as figuring out how recursion works, how to embed one procedure into another, how to put different routines together to get a desired effect. D.H. observed that students synthesize information that they have learned from watching film and use it in a software environment to create their own images.

Architecture and Design: The interim lead teacher has taught the architecture and design curriculum both with and without the use of technology. She observed that the technology made some tasks much more efficient, allowing students to manipulate aspects of the tasks better. This facilitation enabled students to explore and to go further in depth than otherwise possible. The interim lead teacher felt that the procedures and functions associated with computer use in the context of their design projects required students to develop higher order thinking skills. She further stated that the extent to which this occurred was tied to the developmental capabilities of the students and the level of the "match" between the program and what the student was able to understand and do (*some students have advanced more in their work and use of technology, depending on their interests and whether it is accessible to them*).

- Complexity of task students can accomplish ***[taskacc]***
  Both an associate teacher (Animation) and the interim lead teacher (Architecture & Design) felt that the use of technology enabled students to accomplish more complex tasks within their courses. The teacher for the animation class felt that the combination of technology and collaboration in particular led to greater complexity, as students used their "language" to make their ideas explicit, to explore and negotiate solutions, and to engage in an overall more complicated problem solving process. This associate teacher felt that HyperCard was a more challenging tool for animation in this respect, as it appeared to stimulate more language and problem solving than *Animation Works*. He commented that the projects students have created on HyperCard were "things that you would never think of." Students took their projects to levels beyond what he as an instructor ever asked for or imagined (e.g., Pong game). When talking about and sharing what they have done, students revealed important aspects of their problem-solving process (e.g., how they have synthesized information), which deepened the teacher's appreciation for the underlying complexity of their work.

Within the Independent Research course, the use of technology as an information source provided students with additional perspectives and modalities to incorporate into their research.

- Learning on specific tasks ***[kidlearn]***

  Teachers and students commented that the use of the word processor facilitated various aspects of the writing process, such as transcription, revision, and final formatting and publication. Students were able to describe which aspects of (or under what conditions) these tasks were and were not supported by the computer. For example, initial composition and transcription were supported for students with typing skills. Other students preferred writing their first drafts with a pencil, because their thoughts ran ahead of their transcription rate at the computer and it was difficult to generate ideas while attending to keyboard issues. This suggests that, unless typing is as automatized as manual transcription, students may have greater difficulty composing at the computer. All students felt that the editing process was eased and facilitated by the use of the computer, especially given the fact that it bypasses the need for erasing and rewriting. Students discussed the types of changes that they were able to make more readily at the computer (highlighting and moving blocks of text, inserting and deleting words). Several students mentioned that they were more able to identify their errors (e.g., capitalization, punctuation) when writing at the computer, presumably due to the uniform display of text. Students commented that their spelling accuracy was also supported at the computer; however, the spell checker had to be used cautiously because it would often provide spellings for the wrong words (the use of a regular dictionary was still required). In general, students felt that it was easier to use hard copy print outs for proof reading: *"'Cause on the computer, if you don't see it, it will cut off part of the story and you have to move down and check and look at the rest and it's just easier to do it on paper, to find your mistakes and then go back on your computer and change it."* All students felt that final formatting and publication was greatly facilitated by the use of the computer as a writing tool, enabling them to produce professional looking products.

- Creativity ***[create]***

  Within the Animation and Architecture & Design courses, students used computers as tools for designing and creating highly individualized and original products. Creativity was an important emphasis within each of this classes and a criterion upon which student work was to be assessed.

- Greater attention to how a product will be understood by others ***[audience]***
  Not mentioned or observed.

- Technology skills ***[hackskl]***
  The use of technology was an underlying component within all of the School of the Future's Mac Lab courses. School of the Future students were given a high level of access to technology and as a result, most were very proficient in their uses and their understanding of technology, especially within the context of various tasks, such as writing and graphic design. Students demonstrated confidence and pride in their technology skills both during our classroom observations and in interviews.

Obstacles

Student Vandalism

Students frequently reported that the destruction of their computer files at the hands of other students was an ongoing concern. One student interviewed reported that he used 55-character passwords in order to prevent other students from accessing and damaging his files. This precautionary measure seemed excessive, but many students reported that they had files destroyed by other students who learned their passwords.

Lack of Typing Skills

The lack of typing skill was frequently mentioned as an obstacle to composition at the computer. Most students reported that they produced their first drafts with a pencil, then transferred this over to the computer for editing. Students who preferred writing their firsts drafts at the computer described themselves as "fast typists."

Student quotes:

Student who prefers writing her first draft on the computer: *"You can get on the computer, get it down really quick, get it done, print it out and you have it right in front of you—you can neatly organize it."* Another student who "leaves words out" at the computer types finger by finger and loses track; when she reads her text over, "it doesn't make sense." Another student reports that she prefers writing initially with the pencil because *"You don't have to stop to think as often, you just keep writing."* A third student agrees: [When writing at the computer], *"You sit there* *a whole lot of a long time thinking and thinking. With pencil you do it faster, you think faster*"..[whereas at computer:] *"You think about what kind of writing you want it to be in—plain or—" "When you're not good at typing, you look down at the keys..."*

Isolated Tasks and Scheduling

Student investment in and understanding of particular tasks, such as the writing of business letters, may have been enhanced if these tasks were integrated within the context of a broader and more meaningful project. The lack of such integration and the scheduling of 50-minute sessions limited the kinds of tasks and projects that students were able to undertake.

SOUTH CREEK MIDDLE SCHOOL DEBRIEFING

Site: South Creek Middle School

Principal: S. T.

1.0 Summary [*sum*]

South Creek was a middle-class suburban junior high school when it opened in 1973, but was closed in the mid-80s when the district experienced a drop in enrollment. It was renovated and re-opened in the fall of 1991 as a technology-rich "school of the future" serving a student body that is predominantly low-SES and Hispanic. From its inception, the new South Creek combined site-based management, a team "area" configuration, and 90-minute block scheduling with extensive access to technology. In setting forth the plan for this school, the superintendent argued that technology is an important component of a state-of-the-art school that would prepare students for workplaces of the next century. He also saw it as a way to leverage the teachers' skills, by taking over some routine tasks so that teachers can provide more individual attention and coaching. At the school level, the staff have stressed tool and communication uses of technology from the beginning. Students use word processing, graphing, hypermedia, and spreadsheet programs in classes ranging from ESL to mathematics to industrial and fine arts. The two-story library/media center, located in the center of the school, hosts an impressive array of electronic resources and information retrieval services.

2.0 Context and Reform Overview

2.1 Educational Context. [*context*]

Setting. South Creek is located on 21 acres in an outlying area of this Southwestern city. It is part of the Sunset Independent School District, which serves an area once considered suburban but now much more urban in character. (The superintendent describes it as *"one of the most rapidly changing districts in the country."*) A freeway runs through the middle of the district and separates affluent single-family homes (including some of this Southwestern city's wealthiest neighborhoods) from areas of multi-family units housing an increasingly poor, increasingly ethnic population.

The renovated school is a gem. Built around a two-story library/media center, the school contains a series of "areas" which provide five adjacent classrooms for core courses for a set of students who take most of their classes together. The area also contains a well-equipped office for the four or so teachers who use it--desks, phone, scanner, printer, computer are all available. Special classrooms for art, foreign language, music, band, and industrial technology are housed separately, and the teachers have their own well-equipped offices. The school is immaculate. The principal picks up a few small pieces of paper from the slate blue carpet as she gives us a tour. No graffiti; no litter. The modern lines of the refurbished school are softened by the addition of country folk arts and crafts. These touches are especially evident in the administrative office where the principal said she had wanted to avoid a "cold, high-tech look" that might put off some parents and students. The school houses over 400 networked computers with 5-6 in each regular classroom and close to 30 in each of several labs. The school and grounds are well-cared for.

Grade levels. Grades 6-8

2.2 Demographic Information [*demo*]

Circle applicable unit: School Class Project District Other:
Number of certified teachers (FTE): 49
Enrollment as of 9/93: 641
Number or percent free or reduced lunch: 65%
Number or percent LEP or NEP: 160 (25%)
Number or percent special education: 70 (11%)
Ethnic Composition *(Number or percent in each category)*

6 % African American	59 % Hispanic	29 % Caucasian, Non-Hispanic
% Native American	6 % Asian/Pacific Islander	% Other

Estimated percent students w/ computers in home: 5%

2.3 Education Indicators [*stats*]

The principal reports on results of the district's assessment, Monitoring Academic Progress (MAP). At the end of South Creek's first semester, despite the fact that it was sixth out of seven district middle schools in terms of SES, its students were second in terms of mastery of grade 6 objectives in mathematics. This performance prompted some of the other schools to look at what South Creek was doing, notably its use of time with daily 90-minute blocks of mathematics in the sixth and seventh grades. The annual teacher survey of effective schools correlates (originally mandated by the district) also shows high teacher satisfaction with South Creek. The attendance rate is high (97% compared to 95% statewide) and dropout and retention-in-grade rates are low. In 1992-93 South Creek had just a 0.5% dropout rate compared to 3.9% for the state. On the state's assessment system, South Creek students consistently score well above their peers at other schools serving students from similar SES and ethnic backgrounds.

2.4 Reform History [*reform*].

- Nature and when started [***history***]

South Creek was a middle class suburban junior high school when it opened in 1973, but was closed in the mid-80s when the district experienced a drop in enrollment. It was renovated and re-opened in the fall of 1991 as a technology-rich "school of the future" serving a student body that was predominantly low-SES and Hispanic. From its inception, the new South Creek combined site-based management, a team "area" configuration, and 90-minute block scheduling with extensive access to technology.

- Reform Features [***feature***] (circle all that apply)

Nongraded groupings
X Extended periods
Schoolwide themes
X Teacher professionalization
X Authentic assessment
X Use of outside resources

In addition to the technology, one of the things that sets South Creek apart is its use of time. The principal says that in planning for the school she kept three principles in mind, *"Technology, Teaching strategies, and Time"*. She was impressed with the literature on the effectiveness of *"double dosing"* for low-achieving students. She felt that longer periods would give them a chance to complete a lesson cycle, with teachers not only explaining and demonstrating new material but also providing the opportunity for students to practice its application in class where the teacher could provide support and do diagnosis. The extended periods allow for this complete cycle. An other benefit is that "transition time" between classes is minimized because there are fewer transitions This also means less time for students out in the hallways, thus reducing noise and disciplinary incidents.

Another aspect of this use of time is its effect on the teacher and teacher professionalization. Each teacher teaches three 85-minute blocks per day. The teacher then has the fourth block for either team or personal planning on alternate days. This scheduling gives the team a chance to work together, provides teachers with time for mastering new skills or developing new curriculum units, and in general creates much more flexibility for teachers to work with each other. Each team area has a teacher office (those teaching electives have one-person offices) and each office is equipped with *"all the tools you or I would want to have in our office"*. The teachers have electronic mail for communicating with each other and with the school administrative staff. E-mail facilitates communication about students that teachers have in common, disseminating the minutes of committee meetings, and provision of information related to security concerns. Within their classes, teachers use *Class Master* to report attendance and record grades; they report that the software provides great time savings. Thus, the scheduling, the technology tools provided, and the physical plant send the message that teachers are professionals who need time and support for communicating and professional development.

The district and school appear to be serious about site-based management. Major school decisions are made through consultation between the principal and the Operations Committee of 8 elected teachers, including 4 teachers representing the core subjects of math, science, language arts, and social studies, and 4 representing *"everybody else"*. The Committee meets once a week. Operations Committee members also serve on the Campus Advisory Committee, which also includes business, community, and parent representatives. The power of this committee is represented by the fact that while each school in the district gets a certain number of *"personnel units"*, based on their enrollment, the Campus Advisory Committee decides how those units should be used for a particular school.

A portfolio of school accomplishments is maintained, and there have also been student portfolio projects in many of the classes. For example, the eighth-grade teachers in math, science, English, and social studies developed criteria for checking students off on State-mandated and tested objectives in their content areas based on work in the student portfolios. As part of a state project ("Profile Writing"), writing objectives for grades 6-8 were developed and teachers were trained in scoring student portfolio work on these objectives.

- Key Individuals [*key*]

The district superintendent, **Dr. H. I.**, was the original impetus for the remaking of South Creek. When it became apparent that the district would have to reopen an old school or build a new one, he argued that the former option would be more cost effective (although it would cost about $3-4M, that was a fraction of the cost of a new school). H. I. also decided to make the school a showcase for educational uses of technology, a *"school of the future"*. H. I. believed that technology would be a part of students' futures and that its presence in classrooms would magnify teachers' capabilities. His original idea was to have South Creek as a technology magnet, but the idea did not get much political support from district parents who expressed a preference for keeping their children closer to home. Given the demographic changes in the district, the reopened South Creek would serve a widely diverse student body, but one in which the majority of students were low-SES and from minority backgrounds. The school's principal states *"He was taking a big chance, considering the political ramifications of what impacted schools on the other side of the freeway [the high-SES area], other schools and how people perceived them. He distributed the money where it was needed most. He wanted things done right."* The district had a technology director who recommended the selection of the Macintosh platform and purchased the original hardware and network.

Dr. H. I. selected **S. T.**, then an assistant principal at another school, as South Creek's new principal. He hired her a year ahead of the school's reopening and charged her with developing a faculty for a "state of the art" middle school that would integrate technology with instruction to serve a disadvantaged population. H. I. also stressed effective schools principles such as high standards for all students, monitoring and feedback, developing a safe environment, and developing a campus leadership team.

- Funding sources for reform [*funds*]

South Creek has been funded out of the district's general education fund. The principal estimates that her block scheduling approach with provision for 90 minutes a day of either team or personal planning requires an extra 2.5-3 teachers to staff the school. The superintendent is described as someone who will fund an idea if there is a good case that it will benefit students.

The superintendent stated that the district put $2.2M in technology into South Creek. The state's contribution to the district's education fund has been declining drastically as the state legislature deals with issues of school financing (a sore point within the Sunset District). Basically, the district's tax payers have made up the difference by voting for higher property tax rates. Per pupil instructional operating expenditures were $2,734 at South Creek in 1992-93 compared to a district middle school average of $2,677 and a state figure of $2,455. Middle schools serving similar students in this Southwestern state ("campus group" in Academic Excellence Indicator System) average $2,115 per pupil.

- District involvement/support ***[localref]***

Relations between the district and the school appear to be quite good. The district has had a tradition of site-based decision making and appears to follow through on its rhetoric. The superintendent was influenced by the effective schools correlates research literature and supplied moral support for instituting these elements while giving the campus leadership team the chance to make decisions so that it would feel ownership in the school's results. The district set up a structure wherein each school has a Campus Advisory Committee composed of 8 elected teachers, a business representative, a nonparent community representative, and 5 parents (the latter three member types are chosen by lottery from those who volunteer).

The district appears to put an emphasis on staff development. Certainly it has allowed South Creek to develop a schedule that provides for extensive planning periods and other in-service opportunities. The district has recently organized a foundation to raise money to "retool and empower staff". From the superintendent's perspective, the key issue is giving staff the right attitudes and the skills to effectively teach classes that are 2/3 disadvantaged students. The superintendent expresses the conviction that disadvantaged students can achieve to the same high standards as their more economically advantaged peers.

The district is also supporting "lots of curriculum stuff" including using the SCANS report as a guide for thinking about what will be required when today's students enter the workplace of the 21st century.

- State/federal involvement/support [***stateref***]

  The state recognized South Creek as a "Gold Star School", prompting a visit from the state's governor. As one of 90 Gold Star schools, South Creek has gotten five additional in-service days, waivers from a number of regulations, and some media attention. Participation in this program probably paved the way for getting South Creek the T1 connection to the State's education network. The principal feels that the increased visibility of the school is the biggest payoff, giving students pride in their school.

  More generally, this Southwestern state has taken what appears to be a "stick" approach to instituting school reform. In 1990-91, the state mandated site-based management (Sunset had already been doing it for 4-5 years.) The state assessment system has evolved to stress higher-order skills and complex tasks, including a writing composition test. In the spring of 1994, the state test will include a performance assessment component. Financially, the state has not given South Creek any special support; in fact, the state's contribution to the district's general education fund has dropped from 30% to 5%, going from about $1,000 to about $340 per student since 1986.

  Federal funding has had some impact in that Chapter 1 and Chapter 2 money have been used for technology. A district administrator said that they like to use "chapter monies" in this way, rather than for purchasing additional staff. (He notes that once you've brought in additional staff, it's difficult to let them go if the federal funds dry up.)

- Role of tech in reform efforts [***techref***] *(classify and describe)*:

  Part of initial reform concept
  Emerging part of reform efforts
  Parallel effort

  Although the district superintendent was the original instigator for making the reopened South Creek a technology demonstration school, he asserts that the critical factor in designing this school was getting educational leadership and a *"faculty that believes that a 2/3 minority population can learn."* The principal states that in designing the school her goal was not to build a technology school but to create a place that would support teams and team teaching, time for teachers to prepare, an advisory-advisee program, and an interdisciplinary focus.

3.0 History of Tech Applications

3.1 Incentive for Technology Use [*why*]

The superintendent believed that technology was an important component of a state-of-the- art school that would prepare students for workplaces of the next century. He also saw it as a way to leverage the teachers' skills, by taking over some routine tasks so that teachers could provide more individual attention and coaching. At the school level, the staff appeared to have stressed tool and communication uses of technology from the beginning.

The principal considers technology to be a natural part of education: *"It should be a natural part. It's a shame because people out in the public are not educated to that. Many of them are resentful at the amounts of money going in. And yet, I don't know how they can expect their children to be competitive and to be prepared for college. . . .I don't care what field they're in, be it factory worker, office worker, medicine or whatever. [There is no place where there aren't going to be any of these things being used.] It's getting harder and harder to get jobs. You want your kids to get a leg up. It's becoming a necessary ingredient."*

3.2 When & How Application Started [*how*]

The technology innovation began with the design of the school for its re-opening. The district made a major investment in over 400 networked Macintosh LC computers. These computers are dispersed throughout the school, with 5-6 in regular classrooms and about 30 in each of several "labs". The Library Media Center was designed as "the hub of the research network". It contains a number of databases including electronic card catalogs of the holdings of all of the district's libraries, several electronic encyclopedias, videodisk and interactive computer software. Recently the school installed a T1 line to connect their local area network to the state education network which will enable communication not only with these other Southwestern state schools and agencies but also with the Internet. Their enhanced telecommunications capabilities should encourage more teacher and student use of WANs. The school has its own television station and broadcasts every Friday; there is also the capability to broadcast live video throughout the school (e.g., the state governor's visit to a classroom). Each classroom has a monitor and VCR. Most of the technology ($2.2M worth) was purchased for the school's opening. There are upgrades and additional software added every year, however.

3.3 Technologies Used [types] (give numbers for hardware)

X • Microcomputers -over 400 networked Mac LCs; DOS computers in Library Media Center
X • Word processing
X • ILS- one lab with CCC software (not major component)
X • Spreadsheet
X • Other LANs -Macs are networked
X • Hypermedia
X • WANs-12 modems, T1 line provide access to state education network and Internet
X • CD-ROM
X • Simulation
X • Interactive videodisc
X • Animation
X • Videocams and editing equipment

3.4 Target Grades & Curricula [*levels, curric*]

Technology is used at all grade levels (6-8) and in all curriculum areas. Eleven years ago, this Southwestern state mandated computer literacy to be taught in the eighth grade. Given the technology orientation of the middle school, it made little sense to postpone this instruction to the eighth grade, so the school asked for and received a waiver to offer its course in the sixth grade. Half of the sixth graders took the course in the fall term and half took it in the spring. Sixth-grade teachers found it somewhat disconcerting to deal with the discrepancies in computer competency between those who had and those who had not had the course. Further, the computer literacy teacher reasoned that it was wasteful to use arbitrary content when teaching computer literacy. Last year, she decided to redesign her approach and obtained a waiver which allowed her to integrate computer literacy with all content areas during the 1993-94 school year. Instead of a stand-alone class she "co-taught" with all content areas and grade levels. For example, when she wanted to teach the word processing skill of hanging indents (for lists) she went to the science teacher to get some science vocabulary terms that the kids could use for their hanging indent projects. For the ESL class, she worked with the language arts teacher on a project in which students developed postcards with photos or art and text on Hypercard and sent these via the Internet to third graders in California. A portfolio approach was used to document students' acquisition of the computer literacy essential elements. The principal described the paperwork as a "nightmare". Although this approach required much more work on her part, the computer literacy teacher expressed enthusiasm about it when we visited in January. By the end of the year, however, the teachers got together to assess this approach and decided that the students weren't learning as much as they had with the separate course. The approach worked well in some classes where the teachers gave it good support but was disappointing overall. The school will go back to the separate computer literacy course in 1994-95.

3.5 Key School Players [*Infield*]

S. T., the principal, provides strong leadership for the South Creek program. She had no particular background in technology when she was hired, but she quickly boned up on the research literature. From the beginning, she was determined to keep South Creek from being just a technology school, *"...one of the things that I was very much concerned with is some of the schools, 'technology schools', where their test scores dropped significantly. . . . and I think what happened was they became technology schools. They lost the focus of their mission. They were teaching technology instead of the concepts they needed in order to be successful."* From the beginning, S. T. wanted technology to be a "transparent tool" at South Creek.

E. F. was hired as the technology manager. She not only provides in-service training and ongoing support to teachers regarding their use of technology but also maintains the school network. E. F. reports that she has reconfigured the school's network several times. Teachers find her both knowledgeable and nonthreatening. S. T. makes a point about the need for this kind of person "...you need to have someone who takes an instructional role as well as a role of crawling around and putting the wires together and getting things done."

J. K. is the computer literacy teacher. Her decision to try teaching computer literacy as a part of the subject matter classes, the subsequent evaluation of the integrated approach, and decision to go back to the earlier approach exemplify the school's approach of innovate, evaluate, refine.

The school has a Technology Committee that makes decisions about technology purchases. It includes a two elected teacher representatives, the media resource specialist/librarian, the technology manager, the computer literacy teacher, the principal, the district technology director (ex officio), and a parent (inactive).

3.6 Outside Players in Technology Application [*outfield*]

- District involvement *[distr]*

H. I., the district superintendent, was the initiator for the idea of making South Creek a technology demonstration site. The superintendent reports that he put $2.2M in technology into the renovated South Creek. In addition to this investment and the continued staffing for heavy technology use, the district has provided the funds needed annually for maintenance, system upgrades, and new software. He has managed to supply funds to sustain South Creek as a technology demonstration site during a period of declining state funds for education, thanks to property tax increases and *"careful management of the funds we do have"*. H. I. points out that he does not believe in asking voters to approve 15-year bonds to pay for technology that will be outmoded in less than five years.

Although the district made decisions about the original technology purchase, it soon turned decision making regarding the shape of the school and the way technology would be used over to the school's staff while offering the advice and assistance of the district technology director (B. C.) and secondary technology coordinator (P. Q.). Thus, the district followed the model of providing leadership and technical support for technology innovations but leaving decisions about details to the local site. The principal says that as a technology neophyte she was greatly assisted by P. Q. and B. C. who inundated her with literature on technology and student learning. The three women agreed that they wanted technology to be a "transparent tool" at South Creek. They also saw ways in which technology could support teacher communication and take over routine administrative tasks (e.g., attendance, grades). P. Q. continues in her position as secondary technology coordinator. As such, she supports all of the secondary and middle schools, but she is housed at South Creek and works closely with the school's Technology Committee and its Technology Manager.

The district continues to have a Technology Committee as well (on which South Creek staff are well represented) and to maintain a catalog of hardware and software from which schools may make choices. While South Creek has a basic infrastructure in place and is in need of upgrades and maintenance, other schools in the district are just starting to purchase significant amounts of technology. The district has planned for a districtwide wide area network but it is not fully implemented.

- State involvement ***[state]***

This Southwestern state has put considerable emphasis on developing technology skills in students. The state mandates the teaching of computer literacy and has developed a set of "essential elements" in this area. South Creek's computer literacy teacher takes these elements seriously and strives to make sure that she covers them all and tracks each student's achievement of each element. The state has also invested heavily in the development of the state education network which makes it possible for schools to communicate with each other, with the state's universities and education agencies, and, through the Internet, anyone throughout the world with Internet access. The state also has mandated this past year that $27 per student be spent on technology. However, a district administrator pointed out that the state did not provide extra funding to go along with the mandate so that in effect the state is just requiring a technology plan of each district and requiring them to spend $27/student of their state funding on technology. The state's Gold Star program has given South Creek some extra in-service days, paved the way for accessing the state education network, and provided favorable publicity. The program is also designed to enhance access to technical assistance, in areas including technology, but the South Creek staff feel that they are so far ahead of most schools that they have little to gain in the technology area.

- Business involvement ***[bus]***
  Although there is a business representative on the Campus Advisory Team, there has not been any strong contribution from the business community. The principal reports that she and the district have tried without success to find a partner (even the state governor reportedly made same overtures without results).

- Foundation involvement ***[foundtn]***
  The school has not received foundation funding.

- Parent involvement ***[parent]***
  Parents do not appear to be a key element in the technology implementation. There is a homework hotline which supports communication with parents, but they vary in the extent to which they use it. Getting parent involvement has been a difficult problem in general for South Creek, as it has been for most schools with many low-income Hispanic parents. The school has done many things to try to get parent involvement, including a weekend parents' day with casual dress, mariachi bands, food, and busses running from some of the major apartment complexes to the school. Among the parent involvement activities for 1992-93 was a computer literacy open house that brought in just 15 parents (about the same number attended fine arts performances). There were five registered parent volunteers during 1992-93. The principal reports that the main goal on her mind now is to try to use technology to "hook" parents. She is thinking about offering an after-school technology program with bilingual instructors for parents. She is trying to figure out how she might fund such a program.

- Other outside influences, including research
  Both the district superintendent and the principal are active consumers of educational research. The effective schools literature has had a big impact in this district. The principal describes herself as reading "tons" of literature on technology and student learning during the period when she was planning the

school. She also refers to Gardner's research and the literature on "double dosing."

4.0 Overview of Tech Uses

4.1 Student Uses [*kiduse*].

- Tutorial

Although tutorial software is not the school's main thrust, instructional software is available and some teachers use it to help students "build up their skills". One teacher mentioned that she would like to have more software tied to the states required "essential elements".

- Exploratory

The Library/Media Center gives students access to technology that allows them to explore many kinds of content. For example, sixth graders working on a rain forest research project went to the library to use the CD-ROM. They used both an electronic encyclopedia database and *NewsBank*, which allowed them to locate recent articles on rain forest issues. *NewsBank* indexes over 500 newspapers in the United States on issues and events. There is a periodical index and names of famous people in the news, similar to a clipping service. It is sorted by topic and when the company sends the microfiche, it matches up with the CD-ROM.

Students also used the CD-ROM *Traveling-In-Time* database, which allows students to select a character and then explore historical events from that character's viewpoint. (For example, having selected a female character who went to Europe and was highly impressed by what she saw there, students can click the years that she was traveling and see representations of what was then "avant garde" in Europe.)

- Communication

Since South Creek has installed the T1 line, the school has become active on the state's telecommunication network. (South Creek relied previously on 12 modems to connect to the network.) They have a connection through the Medical Center in the downtown area of this Southwestern city. By having the T1 line, the school has more opportunities to have more connections and the students can communicate through their teacher's password, thus letting them get onto some of the Internet services, such as news of the day, the weather, and world politics.

The teachers believe that use of the state network will facilitate student writing because *"if writing can be made public for many people, then the desire to write better will be there."* The teachers have collaboratively created "a global hand-shake survey." This survey is divided into six areas: (1) Favorites, for example, "What's your favorite music?", "What's your favorite snack food?", "What's your favorite sport?"—any favorite things that kids like to talk about. (2) Cultural practices: "How do you celebrate your birthday?", "What is a winter holiday that you celebrate and how do you celebrate it?" Then it goes on to ask, "How do you greet each other?", "Do you embrace?", "Do you shake hands?", "What does your culture say about greetings?" (3) Economic aspirations: "What if you had a hundred American dollars, what would you buy?" (4) Natural disasters: "What natural disasters are common in your area?", "Have you experienced any in your area?" (5) Nature: "What kinds of animals have become extinct in your area?", "What kind of natural fauna and flora do you have?", "What is your average temperature?" (6) Environmental issues: "What kinds of things are recycled in your area?", "How do you recycle them?", "What kinds of environmental issues are in the different areas?", "Is there a pollution problem in your area?", "What do you think causes the pollution problem?" What this global survey is trying to do is to provide authentic data for students to use in databases and spreadsheets and to enable them to write well with this tool. The teachers hope to address the higher-order thinking skills of analysis and synthesis with authentic data. The school has already gotten some responses from Iceland, Brazil, Australia, and the Ukraine.

There is also a homework hotline that the teachers set up. This is a strictly listen-only mechanism where students can call in to find out what their homework is for the days that they've missed.

- Tool

Teachers stress tool uses of technology. In addition to extensive use of word processing, we found use of spreadsheets and graphing tools for the analysis and presentation of data.

In the ESL class, students are using software called "Storybook Weaver," where they write their own stories and design different backgrounds to go with the story. (Words are actually displayed to match with picture items.) For example, in one classroom ESL students were reenacting the story of "Little Red Riding Hood" on the computer with this software. The students are familiar with the story and they rewrite the story in English, incorporating the characters in their story by clicking on the menu and pasting the characters in their "picture" and typing the story underneath the pictures.

4.2 Teacher Uses [*tchuse*].

- Communication

The Macs are networked within the school. The principal can communicate with teachers and teachers can communicate with each other, cutting out a lot of paperwork. The first thing that new teachers learn when they first come on board is electronic mail. The teachers are expected to check their mail. Chimes go off signaling teachers that they have a new message. Teachers use e-mail to send enclosures of ideas for a project to each other. There are different grades and different class groups, such as a science group, a math group, social studies group, language arts group, etc. All these different groups are on e-mail so that the teachers can send messages out to their particular groups about a particular student or particular topic area. Staff also get minutes of meetings as enclosures, which are mailed to all staff in the school. If there's a stranger or someone that looks suspicious in the building, the principal can alert the teachers through e-mail. If vandalism or some other problem crops up, the teachers can alert each other and jump right on it through e-mail without agitating students who are not involved. Electronic mail has been a very popular tool among the South Creek staff.

Each employee also has a voicemail box. They can check their telephone messages either from inside or outside the school and they can leave messages for each other.

There is also a homework hotline that the teachers set up. This is a strictly listen-only mechanism where students or their parents can call in to find out what their homework is for the days that they've missed.

- Presentation

Teachers use word processing and graphic software to develop course materials. One of the teachers we observed used the projection system within her classroom and the computer lab to walk students through software procedures (e.g., how to use a spreadsheet) step by step. She prepares slides outlining key points, as well as sample spreadsheets and graphs for students to use as models. Classrooms are also equipped with VCRs and videodisc players which teachers use for presentation purposes.

- Instructional Management

The use of specialized software for class/report grading and attendance taking has greatly simplified these two daily classroom routines for teachers at South Creek. The school has a site license for *Greatworks*. It is a multiple applications program that has a spreadsheet, a database, a word processor, and it can also do telecommunication. Within *Greatworks*, the teachers use a program called *"Class Master"* as a tool to do grading and attendance. The teachers can put information on the students' attendance in a database format. Various reports are generated on a daily basis and are sent off to the main office at the school, thus avoiding tedious paperwork. This information can be easily modified (e.g., if a valid excuse is received for an absence previously recorded as "unexcused absence"), leaving more time for planning and teaching. With these data on the computer, the information is easily accessible to everybody.

Rather than manually recording grades for each student on a daily basis and then summing, weighting, and averaging them at the end of the term, and transfering the final grades to report cards, *Class Master* allows teachers to record grades onto a spreadsheet. If a teacher or a parent wants to find out a grade at midterm or at some other interval, the report can be generated on the spot. (Unfortunately, there is a compatibility issue with the district office, which is on PCs. Teachers at the end of the term still have to manually bubble students' grades onto specialized forms.)

5.0 Implementation Details

5.1 Problems Encountered [*probs*].

- Difficulties in selecting hardware/software [***pick***]

  The one part of the technology plan that went awry was networking the computer-based library resources with the rest of the school. The original plan called for students to be able to access the electronic card catalog, encyclopedias, and database resources from any classroom. However, it turned out that the library systems (at least at the time South Creek was purchasing them) run on DOS machines while the rest of the school is on Macintoshes.

  The superintendent expressed some regret that the school had taken an all-Macintosh approach. He felt that there was a loss because some software could run better or run solely on DOS machines. The other apparent regret was that the technology remained "state of the art" for such a brief period. Most of the computers were purchased just before System Seven became standard. The superintendent appeared a bit dismayed by the cost and effort needed to constantly upgrade the system. Several school staff expressed some wistfullness about the greater speed available in newer network technology than South Creek's. One said *"While some schools are getting on the information superhighway, we're going to be on a dirt road."*

- Difficulties obtaining hardware/software [***get***]

  The school has had adequate funding and technical expertise for selecting software. (Teachers forward their requests to a Technology Committee that allocates resources.) There has been a sense in some cases of a scarcity of resources aligned with the curriculum and difficulties finding material written at the right reading level, but the schools emphasis on tool uses of technology appears to have minimized this problem.

- Difficulties maintaining systems [***work***]

  The frequency and expense of system upgrades were referenced. The school gets good system maintenance support from the district's Computer Services Department (which was set up to handle administrative computer systems and has added the instructional systems to its charter).

- Theft/vandalism **[*crime*]**

  Not regarded as a problem. They've lost some track balls from the mice, but this is regarded as avoidable with proper supervision (which we observed).

- Teacher lack of knowledge/fear **[*block*]**

  Not a problem because of all the on-campus support provided

- Lack of time for learning to use technology or developing technology- related curriculum units **[*notime*]**

  Teachers can always use more time but this was not regarded as a significant problem thanks to their block scheduling.

- Disappointing results from using technology **[*letdown*]**

  Not an issue.

- Poor alignment of technology w/ instructional goals **[*mismatch*]**

  Teachers seem to have the technology they want for their instructional purposes. We did not hear complaints about a mismatch.

- Lack of funds **[*nofunds*]**

  The technology has been well-funded. The biggest issue appears to be making sure there are funds for needed maintenance and upgrades. The principal states that in recent years the district has spent more technology funds on other schools, which she understands, given the fact that South Creek was way ahead of them. The technology provided to South Creek from the outset has created a "technology appetite" among teachers. They are worried about becoming outmoded (*"When some schools are getting on the information superhighway, we're going to be on a dirt road."*)

- Resentment from nonparticipating classes/schools **[*green*]**

  Although resentment does not appear to be a huge issue here, there were allusions to this problem. However, it wasn't only technology that led to the perception that South Creek was lavishly equipped. One teacher cited a rumor she had heard that the school's home economics room had a $10,000 chandelier.

- Lack of technical support **[*nohack*]**

  The school appears to have the technical support it needs.

- Failure to see fast positive effects on test scores **[*noshow*]**

  No. Test scores have been good.

- Other **[*bug*]**

5.2 Strategies for Overcoming Barriers [*solve*].

- Inservice training/release time

  The school's design for using time, with 90-minute planning periods for each teacher each day offers an unusual amount of time for working on integrating technology into teaching as well as other innovations. In addition, technology topics are often discussed in faculty meetings. The technology manager hosts a "promising practices" series at which teachers describe what they are doing with technology. The district provides for a fairly large amount of in-service time and a good portion of this (an estimated half) is devoted to refining skills in teaching with technology. The other major factor was the presence of a full-time, on-site technology manager plus a computer literacy specialist. With the option for these two to demonstrate new technology and do co-teaching, a great deal of flexibility and support is built into the technology implementation.

- Involvement of outside experts

  Although some consultants were used in the planning of the school's technology infrastructure, this is basically a "home grown" innovation.

- Creative fund raising

  No. Money for South Creek's reform and technology innovation came from the regular general education fund.

- Other

5.3 **Facilitators [facil].** *Describe factors that helped this project, including*

- Technical support on hardware/software ***[techta]***

  The school opened with a knowledgeable technology manager, a computer literacy teacher, and access to a district secondary technology coordinator. This combination provided the teachers with lots of access to people who had technology skills and who were perceived as nonthreatening (all are women).

- Teaching skills (nontechnology) ***[haveskl]***

  As the superintendent said, the major factor in South Creek's success is the combination of educational leadership and a faculty that believes a population of 2/3 minority kids can learn. The principal said that in selecting staff for the school, she looked not for technology expertise but for teachers who were "skilled at working with kids". She cited also the need for a willingness to learn and experiment.

- Technical assistance on integrating technology into instruction ***[instrta]***

  Among the principal's advice to other schools was the need for a person like South Creek's technology manager who could look out for the technology and provide ongoing technical assistance. The block schedule system allows teachers to capitalize on this resource by giving them a 90-minute period per day for planning either in teams or individually. There is also sharing of technology practices at faculty meetings (a "Promising Technology Practices" series organized by the technology manager). In addition, the recently instituted practice of having the computer literacy teacher "co-teach" provides lots of opportunities for the subject teachers to see ways in which technology can be exploited within their content area. New teachers receive several days of training from the technology manager before starting the school term.

- Supported time for teachers to develop skills ***[timesupp]***

  Teachers have supported time during their 90-minute daily planning period and through in-service days, including five extra days obtained from the local school board with a waiver from the state education agency.

- Other

5.4 Costs [costs] *(Estimates in dollars or person months)*

Initial technology costs were $2.2M. Not counting amortization of the technology, per pupil expenditures at South Creek are now comparable to those at other middle schools in the district, according to the superintendent. The principal estimates the annual cost of maintenance, new software, and the computer education center at around $17,000.

6.0 Impacts [*Impact*]

6.1 Effects on Students [*kidout*]. *Include areas such as:*

The principal states that technology forces kids to think and problem solve. She notes also that it expands the imagination and does not dummy down the curriculum. A sixth-grade language arts teacher notes that technology "releases kids to write". It supports students in areas where many ESL students need help through the same tools that all students use (e.g., spelling, grammar checks). A concern is that when students leave South Creek they won't have the same level of technology in high school.

- Motivation **[motiv]**

  Teachers cited positive effects of technology on motivation. For example, a sixth-grade language arts teacher notes that kids have a greater sense of ownership for their technology-produced writing. The librarian notes that monitors are motivating to kids; they prefer the electronic encyclopedias to print; they will read things on a monitor they would not stick with in a book; they like taking home selected pages from an electronic reference.

  The technology has also helped to bring media attention to the school which has in turn promoted a sense of pride.

- Self esteem **[kidestm]**

  The principal believes that technology was a significant force in terms of students' self-esteem and satisfaction in being at the school. *The status that it [being a technology demonstration school] gave us and what it did for our kids here in terms of visitors that come in and the kinds of opportunities to engage in distance learning excite them. It's great to be in school."* The technology manager notes a positive effect on students' pride.

- Attendance, retention, disciplinary rates **[kidbehav]**
  Students are well-behaved and attendance measures are high. When students were surveyed about what they like about South Creek, they listed "the teachers" first and "technology" second. It appears that technology contributes to students' enjoyment of South Creek and the pride that they take in their school. These things, in turn, mean good attendance and reduced vandalism.

- Technology skills **[hackskl]**
  Students are highly proficient with Macintosh interfaces and leave South Creek comfortable with a wide range of software. They understand how a network functions and are aware of issues such as conserving memory. The technology manager notes that students come to take technology for granted.

6.2 Effects on Teachers [*tchout*]. *Include areas such as:*

- Inclination to assign complex tasks ***[hardtask]***
  The principal notes that technology leads teachers to ask kids to think and problem solve, developing more challenging activities for their students. She note also that technology does not "dummy down the curriculum".

- New instructional strategies ***[tchstrat]***
  The principal states that technology changes the way teachers teach—leading them to act as facilitators. She says: *"I truly think that technology has forced us to rethink the way that we relate to kids in the classroom; it changes kids' role so that they become more active and provides them with more kinds of exciting activities, which in essence becomes more challenging and makes them more active learners."*

- Self esteem and sense of professionalism ***[tchach]***
  When the school first opened, students were unhappy about being switched to a new school and there were problems with graffiti and violence. But the faculty pulled together to change this climate: *"Technology was a significant factor in terms of the students' self-esteem and satisfaction in being at South Creek and in making South Creek successful."*

- Communication with other teachers ***[tchtalk]***
  The technology manager notes that technology provides an opportunity for teachers "to learn together". The e-mail function provides teachers with an additional way to communicate about students they have in common as well as about security issues and the content of meetings.

- Use of their time ***[timeuse]***
  A sixth-grade language arts teacher noted that using technology has led her to become better prepared and to keep kids on task for a higher percentage of time.

6.3 Effects on School Climate & Processes ***[schout]***

The superintendent states that technology has a positive effect on school climate and creates more integration across subject areas.

- Increased linkages with outside organizations, resources ***[link]***
  South Creek's use of technology was one of the reasons that the state education agency was interested in the school and made it a Gold Star School. This honor has in turn brought South Creek more attention at the local and state level.

- Enhanced role as magnet ***[magnet]***
  Within the low-SES half of the Sunset District, South Creek is considered a very attractive school and parents try to get their children in. South Creek's reputation is not sufficient, however, to draw more than a few attempted transfers from the high-SES portion of the district.

6.4 External Accountability Measures & Their Influence ***[account]***

Both the district and the state have mandated tests which influence the resources provided to a school. The state rewards schools financially for high test scores. The state also specifies "essential elements", for example in computer literacy, on which students are assessed. South Creek does not appear to "teach to the test" but they are well aware of their test scores. Since their scores have been generally good and the state test itself has tried to tap higher-order skills and not just the basics, there is not a sense that the school's instructional mission has been distorted by the accountability measures. Although there is always a bit of skepticism at the local level about state mandates, the computer literacy teacher, for example, seemed comfortable with the state's essential elements.

6.5 Evaluation [*eval*]

- Test scores

  The high-stakes test in this Southwestern state is given at fourth-, eighth- and tenth-grade levels. Although the test scores cannot be interpreted simply as the effect of technology, they have been fairly encouraging. Examining the figures by SES level in the context of state averages suggests that South Creek does considerably better than most schools in this Southwestern state in fostering the reading and math achievement of low-SES students while performing comparably to other schools with their middle/upper SES students.

Eight-Grade Standardized Test
(percent mastering objectives)

	Fall 1993	
	South Creek	State
READING		
Low SES	54%	38%
U/M SES	77	71
Total	65	60
MATH		
Low SES	37	22
U/M SES	55	53
Total	46	43
WRITING		
Low SES	53	54
U/M SES	76	79
Total	64	71

South Creek does particularly well when compared to other schools serving similar student populations.

Seventh-Grade Standardized Test
(percent mastering objectives)

	South Creek	Similar School	State
READING	45%	42%	53%
MATH	59	42	52
WRITING	72	62	69

- Retention rates

	Grade 6	Grade 7	Grade 8
South Creek	0.4%	1.8%	2.0%
Similar Schools	2.6	2.6	1.9
State	2.3	3.1	2.3

- Attendance

  Attendance ran at 97.2% in 1992-93 compared to 94.9% for schools in this Southwestern state serving similar students and 95.1% for all state middle schools.

- Discipline rates

  There was 1 expulsion this year compared to 7 the first year the school opened.

- Teacher turnover

  Teacher turnover is around 5% which is considered low. Most teachers have been at South Creek since its reopening.

7.0 Reflection and Advice

7.1 Dissemination [*spread*]

The school hosts a constant stream of visitors and South Creek teachers have been active in offering in-services to other schools on the use of technology. The school hosted a technology conference with outside vendors and piloted a state program for career exploration through technology. An interesting perspective on how one school's adoption can influence others was offered by the principal. She noted that many of the Sunset schools had shown no interest in technology until South Creek re-opened. Thereafter, the "green-eyed factor" went into effect and other schools lobbied for the kind of technology South Creek had. The principal saw this as a "brilliant" strategy on the part of the superintendent for getting the district's schools interested in technology. Another consequence has been greater demand for South Creek to provide in-service training, which can be wearing in terms of the time and logistical arrangements required, but the principal looks at it philosophically as part of the payback due for the district's investment in South Creek's technology infrastructure. She has also managed to garner additional resources (e.g., laptop computers) through participation in these dissemination and training activities.

7.2 Plans [*plans*]

The school is expanding its use of wide-area network resources with greater use of the state education network. A second area the principal is concentrating on is parental involvement, which has not been high despite the school's efforts. *"One of the things I thought would possibly be to draw parents ... in so they would have the opportunity to have the same training as the children. And I thought that would be a way to draw them in. . . . Many of them hold down two or three jobs, but perhaps by using technology we may be able to help them with resume writing and things like that. We would offer classes, but of course we would have to do it in Spanish and English."*

7.3 Advice [*advice*]

S. T. reports that when someone starts a schoolwide technology-supported innovation there must be a strong commitment from a leader: *"You just need to have someone out there to fight for the program, who is going to be able to get the funding, who is going to deal with the budget, deal with all those people and be able to knock down barriers. The only thing I want to say about that is if you don't have anybody doing that, then the program becomes a second-, third- , fourth-class citizen. It will be relegated to that role."* She goes on to say that you also need a long-term commitment on the part of the district to maintain and continue the program.

In allocating resources for technology, S. T. recommends spending money on wiring first. This way the technicians will know what equipment is needed. She also advocates hiring a technology manager in the beginning. This will free up administrator time and allow someone with expertise to be involved and focused in this one area. *"There's no way the administrator can wear those two hats, for a couple of reasons. One, she [the technology manager] is in a supportive, non-threatening, non-evaluatory role, which I think is really important. The other is that it shows a commitment to support and it's necessary. Otherwise, we would be crashing."* In selecting teachers S. T. looks first for those who are willing to learn and who interact well with kids. Technology expertise is a plus, but not the first criterion in hiring teachers.

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: Industrial Technology Courses

Teacher: C. D.

Site: South Creek Middle School

1.0 Summary [*sum*]

C. D. teaches a series of courses in "industrial technology" at South Creek Middle School. The courses, which are offered to 7th and 8th grade students as electives, cover a range of topics and activities involving industry, technology, and production. Technology use is integrated throughout each course. The computer is used as a drafting and design tool, a writing tool, and a spreadsheet, as well as for marketing products and student presentations. Most projects are planned and implemented within collaborative groups.

2.0 Classroom Context [*context*]

Teacher Background—General. C. D. has a B.S. in industrial education and technology and a master's in industrial technology education. He taught at the middle school level for 10 years within the Sunset district prior to transferring to South Creek in its first year of operation. He describes his previous lab setting as "the worst in the district," although the school was located in a wealthy community and the students were "really white, nice, and easy." C. D. came to South Creek because of the opportunity to work with students in a well-equipped, computer-supported lab.

Previous Technology Experience. C. D.'s computer experience prior to coming to South Creek was limited. The only computer he had access to while in his graduate program was a "mainframe punchcard" computer. At Sunset Middle School (his previous teaching site), he had one Apple computer and one software program to support computer-assisted drafting.

C. D.'s comments on the lack of equipment at his previous school, in contrast to the resources at South Creek, are summarized here: *"Each year, I would put in a request for computers and video cameras and did not get them. In 1985, [this southwestern state] enacted the 'essential elements', which included technology use. However, they did not provide money for districts to implement.... So we're* *supposed to be teaching how to videotape, but none of us had video cameras. When the opportunity came up to be here, I thought, 'well, I'm never going to get it if I stay here'. When we ordered the equipment, we ordered the best that we could find, thinking that it would be cut in half and we would get the lowest model, but we ended up getting the whole thing.... My last year at Sunset, we worked with a couple Macs that they bought...here I have 10 of them. One of the essential elements was computer-assisted drafting, but I didn't have any computers to teach them on. The neatest thing about working here is that everything is networked, so if we get the site license for a program, the kids can use it anywhere. I had computer programs at [prior school], but it was one program that cost $900 and you could only use it on one computer, so that meant you could only have one kid working on it at a time. So it was basically a waste of money."*

Technology Training at South Creek. C. D. missed the initial summer technology training provided at South Creek because he was out of town. He and other teachers opted for meeting at 7:30 once a week, one-half hour before contract time to go over technology use (e.g., instruction in how to use the phone system, the state education network, and the instructional management software—*ClassMaster*—which was adopted school-wide). C. D. comments that the start of the first school year was difficult because, "*We had millions of dollars worth of stuff and only one or two people knew how to use it,*" and, in addition, his lab was the last classroom area to be completed (it was finished 9 weeks into the school year). Many of the in-services given during the first year were devoted to technology. C. D. feels that the lack of technological expertise and the process of learning as a group was beneficial, promoting a sense of camaraderie amongst the South Creek staff: "*None of the old teachers knew how to do anything, so they were in it together.*" New teachers starting out at South Creek, he comments, are given more one-on-one instruction, but may not have the benefit of the shared learning experience.

Scheduling and Enrollment. The industrial technology courses are offered each semester as electives. Between 70 and 80 students participate each semester. There are fewer than 20 students in a given class. Each course meets for 90 minutes, every other day. C. D. estimates the gender distribution to be 90% male and 10% female.

Classroom Description. The Industrial technology classroom and lab are located in a wing that houses other elective classrooms (Art, Orchestra). The classroom windows overlook the school courtyard. The centerpiece of the courtyard is a deck that was constructed by the 8th grade students in an Industrial Tech class the first year that the school opened. The classroom is equipped with 10 Mac computers, a VCR, and a laser disc player with color monitor. Rows of high work tables with stools line the center of the classroom. A computer-operated C&C mill and lathe, covered with Plexiglas shells and looking shiny new, stand prominently near the entrance. The windows along the inside classroom wall overlook the workshop, which features large worktables, production tools (table saws, welding equipment, etc.), tool cabinets, a wind tunnel used for product testing, and a number of projects in various stages of construction (e.g., a stack of ping-pong table frames, being built by the students in one class for use within the school, line one wall). With the exception of the language in the safety notices posted throughout the room by the instructor, the overall look of the lab is that of a professional workshop.

The District Industrial technology Coordinator played a key role in designing the lab at South Creek. Initially, he wanted to model the lab based on another "high tech" program. C. D. describes this program as expensive to operate and maintain, involving a facility, where small groups of students rotate from station to station working on projects. Based on this model, C. D. states that the district coordinator *"wanted to make everything portable, like a little portable table saw, thinking that this course would be like that applied physics class where you're not going to be producing things, you're going to be cutting out little models."* C. D. was opposed to this approach and was glad to have the opportunity to intervene when he and another teacher were asked to help with the ordering of equipment. They opted for ordering real tools, "with power." It is not clear from our interview how the coordinator reacted to this intervention, but C. D. states that he eventually agreed with the choices made: *"I think he realizes that with this age, they're going to learn more if they're actively producing. The student is going to learn more producing bathroom cabinets and selling them and making a profit and trading in stock...he's going to learn more doing that than if he were making a little cardboard model this big of a little bathroom cabinet and throwing it in the trash can on the way out the door. So to me it's worth it having stuff that they can actually use."*

C. D. feels strongly about providing his students with opportunities to engage in real hands-on production. He believes that this is what makes projects interesting to students—the fact that they are making something that they or others can actually use. His goal is to integrate the math, reading, and essential elements mandated by the state into project-based work in meaningful ways. He comments: *"This class is an elective and if it isn't fun, they're not going to sign up. The thing that a junior high kid wants to do is* **do.** *He wants to do hands-on things. If I had them sitting in little cubicles building little things like that where they never take anything home with them, I'd kill my program. What the state wants me to do is a physics class—studying flight and airplanes. That's fine for a couple of days, but if it's every day, they'll say 'Heck, I can get this in science class; I'll go take home economics where I can cook and eat.' One of the ironies that I fight is I try to keep it fun and we try to cover things and go back and forth, so we'll have lecture one day and we'll do things on the computer another day, and then we'll be in the lab for a week, then come back and do something else, then sneak in reading chapters.... You can't do that until you read the chapter!'"*

C. D.'s courses in industrial technology are planned in coordination with the district, guided by the state-mandated essential elements for this curricular area. C. D. meets with the district coordinator and other industrial technology teachers periodically, and communicates with them via e-mail on the state education network. C. D. comments that he has a lot of freedom and flexibility at South Creek to explore new approaches and to try new activities with his students. In addition to the courses he offers in industrial technology, C. D. meets with other 7th and 8th grade instructors to assist with the planning and implementation of interdisciplinary units. These units involve the coordination of activities within his courses with activities within other subject areas, based on particular themes.

3.0 Reform Features [feature] *(Classification of reform features illustrated.)*

Y Interdisciplinary
Y Extended Activity
Y Project-based
Y Part of Core Program
Y Collaborative Learning
Y Teacher as Coach
Y Mixed Age

Notes:
Industrial technology courses are project-based courses in which students work in collaborative groups to design and produce a variety of products. Courses are offered to both 7th and 8th graders; some classes are mixed grade. The projects

are often extended activities lasting a semester in duration and involving several stages of development and production. Block scheduling (90-minute periods) allows for more in-depth and extended project work (see C. D.'s comments below). Projects are interdisciplinary in that they involve reading (e.g., reviewing manuals, conducting market research), writing (e.g., creating technical reports and project descriptions), math (e.g., drafting and scaling product designs, calculating the cost of materials, testing the product for performance stats), science (e.g., studying physics as it relates to the performance of materials), and graphic design (e.g., engaging in computer-assisted drafting and design).

C. D.'s comments regarding block scheduling: *"For my program it's wonderful. forty-five minutes isn't enough.... I would quit before I'd go back to eight periods a day. Especially when we're working in the lab, I've got time to demonstrate something, give them samples of it, let them make something, or do a little problem solving. Today we had time to go over different forms of industry, then I gave them a problem-solving activity building a paper airplane. They had time to go down and fly and time each airplane, and come back, and we had 10 minutes for closure and review and that was our period. Whereas before, we would have had to spread that out over 3 or 4 days because you've got to review everything, put your stuff away, take it out."*

4.0 Description of Activity [*activity*]

One of the courses developed by C. D. is an introductory course in which a range of industrial technology concepts are explored through a series of small projects. For example, students learn about forming and casting through their use of an injection molder to produce small objects, such as golf tees. C. D. describes one of the projects within this course: *"One of the standby projects that the state has done for years and they have competitions is a little* CO_2*-powered car. It's powered by a little capsule exploding and shoots it down the track. That's the one project that I do every semester with my first semester kids. They do their drawing for it on the computer. They do their testing, they wind tunnel test it (with a wind tunnel for positive and negative lift and overall drag), their final weight, and everything. They tabulate all that on a spreadsheet and then they pick who they think is going to be the winner by who has the best stats on their car. We go through the whole car industry—how the car is designed through construction. The design work is done on the Great Works draw program—it's simple and basic and enough for middle* *school."* [Software note: C. D. comments that he has *Claris Works*, which is more sophisticated (e.g., it allows students to rotate drawings). A few students have requested this program and are exposed to a more technical type of drawing through this. However, the site license issue and the fact that it is a more complicated program to teach and use have prevented C. D. from using this software with the entire class. He notes that the *Great Works* gives them the basics of any CAD system (e.g., snapping the lines to grid, scaling) and is sufficient for most students.]

Other projects are highlighted and described:
Whenever possible, C. D. likes to involve students in creating products that benefit the school community. The wooden deck, located in the school courtyard, was built by C. D.'s 4th semester class the first year that the school opened. Students "*went through the whole construction process. The class split up into cooperative groups. One group worked on the model. One group called all over town trying to find the best prices on materials. They did a spreadsheet on prices from different stores, so we could get the best prices from different places. A couple of other groups worked on footings and cement work. All groups worked on digging holes and doing the cement work, but there was one group in charge. The whole class worked on it.*" C. D. comments that students take a great deal of pride in this kind of project, noting that the deck has survived 3 years unmarred out of respect for the fact that it was student built: ..."*to this day there has been nothing written on it. How many bench seats have you seen in any public building that doesn't have gum stuck under it? That's a neat thing if the kids self-buy into something.*"

Another project that involved making objects for use within the school was the "dinosaur project." C. D.'s goal in putting together the dinosaur project was to "make drafting more fun" and to support computer-assisted drafting. C. D. applied for and was awarded a $250 mini grant to support the cost of the project (through a district-sponsored competition for funds provided by local businesses). The project involved having the students create three large (approximately 6 feet high) wooden dinosaur models, which are currently on display in the school lobby. First, C. D. had the students draw a grid on the computer and then gave them each a miniature dinosaur bone out of a plywood dinosaur kit. They traced the bone onto their grid and were instructed to enlarge the grid by hand onto a large sheet of butcher paper, scaling the grid every 2-1/2-inch square instead of 1/4-inch squares. They had to cut out the bones that they transferred. The bones were then assembled. C. D. comments that the activity took 4 weeks and met several of the essential elements for drafting (e.g., safety and production). One of the science classes is currently making plans to bury the bones and have an archaeological dig. [C. D. quips, "*My kids that don't believe me about manual labor are going to shovel dirt, so they can get an idea of what it's like to be a ditch digger if they don't stay in school!*"]

Last semester, students created pinball games in one of C. D.'s introductory courses. C. D. divided the class into problem-solving teams of four. He then provided them with a set of criteria: the game must include a ball, 'it must roll,' it must take more skill to get more points. The teams developed prototypes for the games out of cardboard and paper. "*We had everything from basketball shooting games to things being shot by rubber bands to bowling-type games.*" The games were presented by the teams to the class and the students voted on the two most popular ones. Then each student produced one of the two games, using more substantial materials.

C. D. teaches a manufacturing class in which students form companies and produce products for sale (e.g., wine racks, cabinets, folding wooden stools). The students enact various phases of the development of a new company. They vote on officials (e.g., Vice President of Research and Development, Vice President of Finance), divide into work teams, and conduct board meetings. For the first 3 or 4 weeks of the class, they work in their teams to plan and develop their area of the company's operation. Many activities are supported by the use of the computer. For example, the Finance team uses the computer to create spreadsheets for finding lowest-cost materials and to create financial statements. The Research team draws their design plans using drafting software. The Marketing team creates advertisements and product descriptions using the word processor. C. D. has a neighbor, who is a graphic artist, critique the ads and this information is shared with the students. The students also created their own videotaped commercials, which are then aired on "Night Time News," over the school's broadcast system. Technology use in production, which is undertaken by the class as a whole, depends on the product being made. C. D. tries to incorporate the computer-controlled lathe or mill into making one small part of the product so that students are exposed to this technology. Final production is conducted in assembly-line fashion, with some students acting out the parts of robotic arms (the parts are laid out in specific locations, students move like robots to place the parts on the line), as if production were fully automated. Products are sold within the school community. Students sell and buy stock and once the product is sold, stockholders get one-half of the profits.

C. D. collaborates with other South Creek teachers in the planning and implementation of interdisciplinary units. Several interdisciplinary units are planned for each grade level every year. The units have focused on a variety of themes (e.g., Jobs, Colonial Days, Egypt, Environmental Studies). In some cases, the units last several months and involve the ongoing coordination of activities across subject areas. The 8th grade Job unit is one such extended unit. In Language Arts, students work on developing résumés and filling out job applications. In Industrial technology, the manufacturing class corresponds to this unit (i.e., the class in which students start their own company and go through each stage of developing, manufacturing, marketing, and selling a product). In Science, students learn about jobs within the field of science. The unit culminates in a Jobs Day, featuring speakers within various fields of work. For the Egyptian unit, C. D.'s class built a pyramid in front of the school. "Colonial Day" involved transforming the lab into a blacksmith workshop. Students rotated between classroom stations every 45 minutes, completing a small project at each station. They made metal candleholders in industrial technology, after making candles at the Art station. C. D. plans to have the students make fire-starter logs out of recycled sawdust for Environmental Studies Day. C. D. comments that he would like to integrate Industrial technology with other subject areas throughout the school year. He feels that this approach enables students to make more connections across disciplines and he enjoys the collaborative process of working with other teachers to come up with relevant projects.

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y • Microcomputers
N • ILS
Y • Other LANs
Y • WANs
Y • CD-ROM
Y • Interactive videodisc
Y • Videocams and editing equipment
Y • Other: Computer-controlled lathe and mill; range of workshop/manufacturing equipment.

Y • Word processing
Y • Spreadsheet
N • Hypermedia
N • Animation
N • Simulation

Note:
The classroom is equipped with 10 Mac computers, which are used for drafting and design, for word processing, for telecommunications, and with spreadsheets. C. D. comments that all drafting is done on the computer—he has T-squares that he gets out only to show students what they are and what draftsmen used to use them for. The computers are networked and most software is site licensed, so students are able to work on their projects even when not in class. Students are encouraged to access outside information sources via the state education network; some classes have involved accessing information from NASA over the WAN. CD-ROM is used for some research projects, through the school's library media services. Videotapes and videodiscs are used occasionally for classroom presentations. Video cameras are used to tape student projects, and to create commercials for the products created in manufacturing class. C. D. edits the tapes himself, because he feels that it would be impractical to involve students (due to lack of time and too many goals). The commercials are aired over the school's broadcasting system. C. D. has the equipment to teach photography, but comments that he has not found the time to use it.

6.0 **Technology Use** *Classification and description of how technologies were used.*

- Student Uses **[*kiduse*]**

C. D. comments: *"I try to use some form of technology in...everything my students work on whether it's a problem-solving activity or a product that they are going to work on when they're working in a company...."*

Tutorial ***[tutor]***
Tutorial uses are not described.

Exploratory ***[explore]***
Exploratory uses are not described.

Communication ***[commtn]***
The students are given extra credit for accessing outside information sources over the state education network when conducting research. Several projects have involved accessing information through NASA over the network. C. D. believes that he could do more with telecommunications in his class, given South

Creek's resources. However, he finds it difficult to use the network for his own professional use and this may prevent him from exploring further uses on the part of his students.

Tool *[tool]*

As in the real world of industry, tool uses are the most common use of technology within C. D.'s classroom. The computer is used as a word processor (e.g., for creating technical reports, commercial scripts, and project descriptions); a spreadsheet (e.g., for calculating the cost of materials, testing and comparing product performance); and as a drafting and graphic design tool. Computer-controlled tools—a mill and a lathe—are used to make small parts for larger products.

- Teacher Uses *[tchuse]*

Communication

C. D. communicates with the district coordinator for industrial technology and with other teachers over the state education network. However, he finds this form of communication to be less comfortable than face-to-face or phone conversations, and he comments that his coordinator "is on [his] case" because he only logs onto the network every 2 weeks or so. In reaction to his network inactivity, his coordinator has started sending him messages every day, so that he'll be backlogged if he does not acquire the habit of checking in more often (*"It would be easier to call me on the phone, but no, he has to be technical about it!"*)

Presentation

C. D. describes himself as "a chalkboard man," who depends primarily upon lectures and hands-on demonstrations to get his message across to students. He comments that he uses video during classroom presentation more than he used to in his previous classroom, attributing this to the fact that he used to have to sign up a week in advance for the VCR, while at South Creek he has his own equipment in the classroom. C. D. feels that using the computer to develop presentations would not be time efficient (*"It would take several hours to develop a 10-minute slide show"*).

C. D. makes several comments regarding the importance of providing his students with opportunities for direct observation of the concepts that he is trying to teach. He feels that technology makes it possible for him to present and address the state-mandated essential elements within industrial technology, which include teaching students about video recording and computer-assisted drafting: *"If I didn't have any computers in here and I was trying to explain computer drafting, that would be practically impossible. I could show a film about it, but until the kid gets on there and draws a line and simply pushes shift-button-D for duplicate and he can duplicate lines exactly like it in a fraction of a second, he's not going to understand the benefits of computer-aided drafting over having to move his T-square and draw his lines carefully and getting graphite all over his paper. So for the other schools in our district that don't have a set-up like this, I feel for them because they're getting shorted in that respect. So I'm real lucky."*

Specialized equipment, such as the wind tunnel, allows C. D. to make dramatic hands-on presentations regarding difficult concepts: *"With the CO_2 car project, without the wind tunnel, I could hold a car up and say, 'When air passes like this, it's going to push downwardly on this car.' And they would say, 'Okay, [Mr. C. D.] Right.' Or I can put the car in a wind tunnel and I can take some smoke and let it float past that car and they say, 'Oh, wow. It has to go up and down and around. Maybe he's right, maybe that does push down.' Or I can take a little styrofoam airplane wing in the wind tunnel and I can turn it on and they can see it trying to lift off its face and say, 'Maybe he's right...about the little story about the particles of air.' From that standpoint, I think they get a better vision. Any time you see and touch and feel and smell, you're going to remember as opposed to reading it in a textbook."*

Instructional Management

Along with all other teachers at South Creek, C. D. uses an instructional management software system, *ClassMaster*, to take attendance, and to record and calculate grades (this program is described in greater detail in the school-level debriefing form). Being able to take attendance at the computer eliminates the necessity of "students running around picking up slips." C. D. feels that the software simplifies the grading process and makes it easier to monitor student progress. However, he is frustrated by the fact that he still has to complete "bubble sheets" by hand for the district every semester. [Several teachers have commented about this. The district is on an MS DOS system and is unable to merge the information on student grades generated on South Creek's Macs.]

C. D. appreciates the convenience of being able to access student work easily from any computer through the school's LAN: *"They can store their work in the file folder and if I want to grade it, I can call it up and grade it."*

C. D. comments that the uniformity and the precision of text and drafting assignments created at the computer allow him to monitor and assess his students' work with greater accuracy and precision: *"One thing for me is anything that is printed out on a laser printer, I can read. If anything else, any writing assignment I give, it's required that they do it on the computer. They may still misspell every other word, but at least I can read what is misspelled. That for me is worth it. I used to spend a week in my other school just teaching how to print. They've forgotten how to do it by this time...learned in the first grade and then learned that scripting garbage and I couldn't read a thing that a kid would turn into me. So this helps me to grade and be more accurate. On the computer, if they make a mistake, it's a lot easier to spot because all the lines should be perfect. If it's one grid point away, it's a lot easier to spot and you know exactly what they did."*

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration
  Yes. Peer-to-peer collaboration is an essential part of C. D.'s instructional approach. Students usually work on projects in groups of four or five. He believes that it is important for students to learn to work in teams because *"this is what industry is going towards."* Technology provides opportunities for collaboration and makes it easier for students to share their work.
- Independent exploration
  Not addressed.
- Access to outside information resources
  Yes. C. D. encourages students to use the state education network as a resource for accessing outside information, but states that he does not use the network as often as he could, due to time factors: *"When students do a technical report, they have an option to earn extra credit by using [the network] to get information from somewhere other than the school library. The majority of my kids will use the library. I should use it more from the standpoint that they could*

see how networking works...but then again I'm on a time frame and I've got so many essential elements to get through in a semester, I never do them all."

- Support for higher-level thinking

  Not addressed.

- Creativity

  Not addressed as an objective. C. D. mentions that students generate many different ideas for projects when working in teams.

- Technology skills

  Yes. C. D. feels that learning technology skills is a central goal in all of his courses. He believes that technology mastery is necessary for future success in the job market: *"The course is Industrial technology. It's my job to tell them that they are not going to get a job unless they are technology literate and unless they understand the concepts of it and how it applies to life."* He notes that the technology skills required to operate some of the more sophisticated pieces of equipment, such as the video editing equipment and the computer-controlled lathe, are too advanced for middle school students (or would take too long to teach). With respect to this equipment, he feels that exposure to the potential and the use of the technology is enough: *I have a couple of programs that came with [the computer-controlled lathe and mill] and that I've written, and I put a part in and say, "This is how it works in industry," which I think is enough for them because they are not going to have to work on that model or to program when they get a job. As long as they know the concept behind it, "Wow, a machine can make this part, no longer am I going to be the one that has to make it. I just punch 'go' and it's made."*

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***

  C. D. feels that students are motivated to use computers, video cameras, and other technology, in part due to their association with the real world of industry. Using real equipment makes their work more meaningful. However, C. D. feels that motivation to do challenging work with the computers is not what he would like it to be (see *Obstacles*, below).

- Attendance, time on task, discipline ***[kidbehav]***

  C. D. notes that all of his classes are electives—which means that they have to be interesting or students will not sign up for them. Technology is one of the elements that C. D. believes keeps students coming to his classes and staying on task. Using real tools of the trade, including computers and video cameras, to create products that have functionality and/or aesthetic value is especially motivating. In addition, the 90-minute periods allow for more "time on task," as this eliminates some of the time spent reviewing, setting up, and wrapping up at the beginning and end of each session.

- Amount of collaboration and cooperative learning skills ***[cooplg]***
  C. D. does not comment specifically on how technology supports collaboration within his classes. However, it is clear from the interview that group work is an important component of each class. Students work in teams of four on most projects, engaging in collaborative problem solving, design, reporting, and production. The computer facilitates this cooperative activity in that students are able engage in collaborative writing and/or drafting and are able to share their work more readily (e.g., easier to read one another's texts and graphs, ability to download one another's work and print out multiple copies).

- Ability to manage own learning ***[selfreg]***
  Not addressed.

- Access to outside information resources ***[outinfo]***
  Students in several classes have accessed the state education network to go to NASA to access information. C. D. offers extra credit to students who draw information from outside resources through the network when conducting research. Most students do not take advantage of this option unless it is required, however.

- Support for higher-level thinking ***[higher]***
  Not addressed by C. D.

- Complexity of task students can accomplish ***[taskacc]***
  The Management class, in which students enact the creation of a company, is one example of a complex, multifaceted project that is greatly facilitated by the use of technology. Many of the tasks undertaken in this project—e.g., calculating the cost of materials, engaging in drafting and design, creating technical reports and financial statements, producing commercials to advertise products—either

require or are enhanced and advanced by the use of technology. Since the class is designed to simulate the real world of industry, the use of professional tools of the trade, such as word processors, spreadsheets, drafting programs and video equipment, supports the authenticity of the task. These tools enable students to accomplish more complex tasks, as well as providing them with opportunities to learn some of the technology skills and concepts that are central to the accomplishment of these tasks within industry.

- Learning on specific tasks ***[kidlearn]***
  C. D. feels that students develop their math skills when using spreadsheets. Students use spreadsheets in most of his courses, for example, to calculate and compare the costs of materials, to keep track of sales and profits, to generate financial statements, to examine and compare the performance stats of a particular product.

- Creativity ***[create]***
  Many projects, such as the design of new games, call for creativity. Computer-assisted drafting may facilitate creativity in that students are able to manipulate and alter their designs for products with much greater ease. Changes can be made to designs with the push of a few keys. Students can see the results of their manipulations immediately on screen. In addition, the computer provides greater opportunities for feedback from others (public display of designs on screen, multiple copies of printouts). The opportunity to create their own video commercials to advertise their products inspired them.

- Greater attention to how a product will be understood by others ***[audience]***
  Students use spreadsheets and word processors to create financial statements and technical reports for others to read. These applications enable students to produce professional-looking documents, which they take pride in sharing with others. Formatting and display options, as well as ease of text editing, make it possible for students to manipulate various aspects of their documents with attention to audience needs.

- Technology skills ***[hackski]***
  Technology skills and concepts are a primary focus of the courses in industrial technology. As in the real world of work, these skills are learned within the

context of broader tasks—projects that typically involve the design and production of products that students will want to use, share, or sell. Students use the computer as a word processor (e.g., for creating technical reports, commercial scripts, and project descriptions); a spreadsheet (e.g., for calculating the cost of materials, testing and comparing product performance); a drafting and graphic design tool; and as a telecommunications medium (e.g., accessing information from NASA for a research report). Students learn to operate video equipment in the context of producing commercials to advertise their products. In addition to learning specific technology skills, students are gaining firsthand knowledge regarding the uses of technology to accomplish a variety of tasks within industry.

Precision in work

Noting the importance of precision in drafting, C. D. praises the computer's support of this aspect of his students' work: *"...especially in middle school, where they're growing fast and their bodies are changing.... I could have a straight-A student who couldn't draw a line because he has grown 6 inches in the last 2 months and his eye-hand coordination is all messed up, so I end up giving him a bad grade when he really doesn't deserve it. On the computer, when you move the mouse to a certain point, it's going to lock there...."*

- Obstacles to implementation

Lack of Motivation. C. D. feels that South Creek students do not understand the importance of technology in their lives and sometimes lack motivation to do challenging work: *"It's my job to tell them that they are not going to get a job unless they are technology literate and unless they understand the concepts of it and how it applies to life. Fifty percent of my kids don't get it. That's the hardest thing, to motivate them to understand that even the guy changing tires at the Goodyear shop has to know how to use computers to run the cash register. For some of them it doesn't click and I spend the entire year trying to get that through their heads...A lot of it is laziness, which is part of a kid's programming at this stage. Some tend to be lazy, others energetic. At our school, some of it is a cultural thing, too. We're 70% Hispanic and a lot of our kids see that their parents aren't using computers if they're in a manual-skills-type job and so they think, 'Well, why am I going to have to learn that?' So that's the cycle I'm trying to break. I mean, the kids love the computer, don't get me wrong there. Some of* *them love to go make little banners for their girlfriends, but they don't do their work."*

Outdated Equipment. C. D. laments the fact that some of the most costly pieces of "high-tech" equipment purchased for use in the lab are already outdated. Specifically, the computer-controlled lathe and mill were poor investments ($10,000 each) because they require a level of programming skill that is too advanced for middle school students. Consequently, this equipment has been used primarily for demonstration purposes, for making small parts of larger projects, and for producing small projects such as miniature baseball bats and ceiling-fan pulls. *"I have a CNC mill and a CNC lathe, which is computer-controlled equipment. The problem with them, just like with everything in technology, is that they are already antiques. They require the student to program all their own G codes to make a part, which at a junior high level, it's rare if you have more than one kid in the class that could do it—I could probably get them all to do it, but I'd have to take the whole semester teaching them how to do it. For me, those machines are kind of antiquated and it's tough for me to use. I have a couple of programs that came with them and that I've written and I put a part in and say 'This is how it works in industry,' which I think is enough for them because they are not going to have to work on that model or to program when they get a job.... The next year's model would have allowed students to put in their drawings on the computer screen, enter some G codes and press return, then it would have made the part."*

Repair and Maintenance. C. D. feels that he has been provided with "a decent budget" for maintenance. He also believes that the principal will come up with funds to meet repair and maintenance needs as they arise. However, with all the state and district cuts that have occurred, he worries about the cost of keeping the lab running. For example, within the first year of warranty, the CNC lathe had to be shipped back to England for repair. Without the warranty, this would have cost thousands of dollars.

- Recommendations to other sites

When asked to describe his recommendations to other teachers in his field who are considering the use of technology, C. D. shares the following: *"Two biggest things that I tell everyone in my program. Make sure that you're networked and*

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site licensed. If you're going to have computers, make sure you have enough for two [students] per computer. They can store their work in the file folder—if I want to grade it I can call it up and grade it. The other [recommendation]—if you're going to get expensive equipment like the lathe, if it's for the middle school level, make sure that it's a demonstrative type of machine where the machine can do it all, where the kids don't have to learn months of programming in order to use it. Or they'll say, 'Well, I don't want to work in that industry if I have to learn all that.' ...You don't have time to teach them all the basics of high-tech equip...they just need to get an idea of what's out there."

CLASSROOM-LEVEL DEBRIEFING FORM

Short Title: Middle School Mathematics

Teacher: J. A.

Site: South Creek Middle School

1.0 Summary [*sum*]

J. A. teaches mathematics to 7th graders at South Creek Middle School. Students attend math classes every day for 90 minutes. These extended periods allow for greater in-depth project work and intensive instruction, as well as time for independent and collaborative exploration. The use of spreadsheets, word processors, and skill-oriented software is integrated throughout the curriculum.

2.0 Classroom Context [*context*]

Teacher Background. J. A. began teaching at South Creek when it opened 3 years ago. Previous to that, she had taught 6th grade for 5 years at an elementary school within the same school district. She was attracted to South Creek because of the technology and the opportunity to work with disadvantaged students. She was also interested in making the transition into middle school teaching:

"I wanted a change after 5 years, to see how middle school was run and to see what goes on there. And as soon as I heard that South Creek was opening up and it was going to be a technology school with the majority of kids being minority kids and low-SES kids, I wanted to come here because I came from a school that was predominantly Caucasian and middle class students. And this is the complete opposite." J. A. was particularly drawn to a setting in which students who had little access to technology outside of school would be given real access to these resources: *"I knew that the school was going to have 400 computers, five or six in your room, so I thought, what a great opportunity to get the kids on the computers. Some of the kids have come to our school without any real technology. I was real happy. I was happy to know that they were going to be Macintosh computers too, because I think that they are very user-friendly, very good for education. I think those are the best ones to use for our kids. That's what attracted me."*

J. A. had little previous technology experience prior to coming to South Creek. However, the little exposure she did have (when teaching 5th grade) left her enthusiastic. She entered South Creek eager to learn and with a positive attitude about learning right alongside, as well as from, her students:

"I didn't have much technology when I was in school. About the most I got was in college and it wasn't that much to begin with. So I thought this is my opportunity to learn with the kids. And they soak it up far faster then we do. They just soak it up and go, and then I ask them 'Show me that again,' because I don't always catch it. They're very comfortable with it."

In addition to learning with her students, J. A. has received a great deal of support from colleagues on her teaching team and from the school's technology manager:

"My team was the most supportive group. If one of us didn't understand, and somebody else understood it, during our team planning we'd sit down and we'd teach each other, we'd stay after school. We all felt a little bit overwhelmed, because a new school is overwhelming, but throw the technology on top of it and we really felt overloaded, but we had a wonderful team, we've always had a good team, so we worked well together, and our technology manager is just wonderful. If we didn't understand something, we'd ask her, 'Is there something you could do for us? Maybe we could set up a planning period and you could come show it to us.' Or show one of us, and one of us could pick up the ball and show somebody else on the team, and so it worked that way. It's been wonderful. The most supportive group has been my team."

J. A. missed most of the summer training sessions offered by the school prior to its Fall 1991 opening. She comments that her anxiety level was high to begin with, given her lack of previous experience. Her first uses of technology centered on mastering the instructional management software that the school had adopted (*Class Master*). J. A. found that, once she got over the initial hurdle of learning how to use the program, this software greatly aided many of the tasks associated with instructional management (e.g., grading, attendance). J. A. comments that this technology-based support is now fully integrated into her work, to the point where it is difficult to imagine functioning without it. *"There were some sessions during the summer that you come and take. I was out of the country, though, so I came and did one of the sessions for about a day, and it helped ease some of the anxiety, but nothing compared to what we felt once we got here. Once we got here and got* *used to it, it's been wonderful, from grades to attendance to e-mail, it's wonderful. It's fantastic. If I went to another school, I think I'd be in trouble. I don't think I could function very well, because I take it for granted."*

J. A. describes her first year at South Creek as a time of learning and gradual mastery of technology. By her second year, J. A. began taking a more active role in integrating technology into her mathematics instruction. *"My first year here I was very apprehensive. I knew that I was coming into a technology school and I came from one where there was very little technology whatsoever. So I wasn't used to the technology and we [the students and teachers] were learning together. Then I felt comfortable enough the second year to actually do a big project]."*

J. A.'s second-year project, a graphing activity in which students use spreadsheets to calculate, compare, and display estimated and actual measurements, was highly successful. J. A. has built on this activity in subsequent classes, and has provided other teachers with training in the use of spreadsheets for graphing activities. *"I taught a group of about eight teachers how they could use graphs...not only in math but how it applied in science, language arts, ESL, and all the classes, and they've taken it and they've used it."* While she still considers herself a novice and a learner with respect to technology, J. A. is taking increasing responsibility for assisting other teachers in the areas in which she is most comfortable. For example, she is currently working with the technology manager to develop a training module on mathematics "pull-out lessons" that teachers can use in concert with *Claris Works*. This session will be offered as part of a school-wide training focusing on the *Claris Works* software and how its integration into the curriculum can support the "essential elements" (or learner outcomes).

In her third year at South Creek, J. A. appears to have reached a level of ownership and expertise that has enabled her to orchestrate the use of technology within instruction, as she continues to build on the uses of spreadsheet, word processor, and math-related software within her classes. Her approach is to guide students through the basics (e.g., how to use a spreadsheet, how to create a graph from data that has been entered into a spreadsheet) in a step-by-step fashion, while allowing them the time to explore some of the different options within the applications (e.g., various ways of formatting graphs).

J. A. explains that she has high expectations for her students. She believes that having and communicating these expectations is important to the self-esteem and achievement of her students: *"I have very high expectations for my kids. A lot of our kids have weak skills but I don't water it down. If anything I try to pick them up and say, 'You've got to be able to do this. I can't do 4th or 5th grade math with you. You've got to do 6th because when you go to 7th, they're going to expect you to be able to do 7th grade math.'"* J. A. feels that access to technology, coupled with clear instruction and high expectations, provides students with the tools and the motivation to learn.

3.0 Reform Features [feature] (Classification of reform features illustrated.)

Y Interdisciplinary	Y Project-based	Y Collaborative Learning	N Mixed Age
Y Extended Activity	Y Part of Core Program	Y Teacher as Coach	

Notes:
One of the strongest and most unique features of South Creek Middle School is the approach to scheduling, which allows for extended periods (90 minutes as opposed to the traditional 45) and daily teacher planning time (90 minutes per day). While J. A.'s classes focus on math, they are interdisciplinary in the sense that they are often integrated with activities going on within other subject areas. This integration is possible because teachers plan their courses in teams. There are two teams at each grade level. Each team has its own "area" with a central shared office surrounded by the separate individual classrooms. For the most part, students stay within an area, going from class to class and working with the teachers within a particular team. Each team typically includes at least one teacher in each of the subject areas: mathematics, social studies, language arts, and science. The teams have collaborative planning time every other day for 90 minutes. Teams within and across grade levels meet periodically to coordinate the curriculum. This approach allows for a "spiraling curriculum" in which subjects are addressed in interdisciplinary and increasingly more sophisticated ways.

J. A.'s comments on the team approach: *"We have an idea of what kinds of projects the students will do in other grade levels. Most of us have been here 3 years, so we're familiar with the curriculum the 7th and 8th graders will be using. And we've had faculty meetings where we have had presentations, so the teachers* *that have done projects using technology, they've presented it to the whole faculty and we saw what was going on so we knew and could say, 'Hey! Maybe we could make it easier for you if we introduce this skill at this level and then in 7th grade take that skill and take it to another level, and by the time they get to you, it's going to be a snap for the kids.' They would really know what's going on. It helps to see what the teachers are doing. [Comments that this wouldn't be possible if they did not have the regularly scheduled meetings.] If we didn't have the opportunity to see, there would be much more overlapping and not taking it a step further. We're trying to spiral it up as much as possible."*

J. A. attributes much of the success of the mathematics program at South Creek to the use of block scheduling—students are given 90 minutes of math instruction per day. The longer periods allow her to go into greater depth and to engage students in projects that include collaborative work and exploration, as well as instruction and review. J. A. believes that having the additional instruction in math, as well as language arts (other subject areas meet every other day) provides students with a basic foundation of knowledge and skills, which are critical to their learning within other subject areas. Finally, she feels that block scheduling works particularly well with disadvantaged students, whose home lives preclude being able to work on their studies after school hours. *"Block scheduling allows them more time to concentrate on what they're working on. When you have a 50- or 60-minute period, 10 minutes is spent trying to get the people settled, getting the roll, collecting things, doing this or that and the other. You still have to do that in a 90-minute period, but it allows you to do more in depth and what I love about the math is that we get them every day. Language arts and math...those are the skills that they definitely need to have in the real world. Social studies is very important and so is science, but they have to have the reading and the math to have a good grasp [of these subjects]. For the most part, I think it helps our kids specifically, because when they go home it's a different world. It's very tough. Many of them are not able to go outside and play. It's not a safe environment in which to live. A lot of them would like to stay after school."*

J. A.'s approach to teaching is a combination of direct instruction and "teacher as coach." She spends a portion of each class period guiding students through concepts and procedures in a step-by-step fashion. She then stands back and provides students with the opportunity to work and explore on their own, or in collaboration with their peers, providing assistance as needed. J. A. feels that technology assists her in her role as a facilitator, in that she is able to step back and let the computer provide individualized feedback and an interactive context for learning. Her comments regarding the need for more math software that supports this level of activity are illustrative: *"Instead of having to teach it the old fashioned way, we need something for the computer...just put it on the computer, and see how that can be taught to the kids and see how well they accept it that way. And if they learn it better on the computer—allow them. We would just sort of be a helper if they didn't understand. We would just stand back and watch and see how the learning proceeded. So that's the main concern I have."*

4.0 Description of Activity [*activity*]

J. A. describes the graphing activity: *"Students will be learning to use spreadsheets and graphs. First, they collected data last week about dimensions: the width of their smile, their eyebrows, jaw line, height of ear...in centimeters. One of the skills in math is that they have to be able to collect data. So we thought we would collect data on something that they would be interested in—themselves! So they paired up or had three people working together and they estimated first. We had worked with centimeters and we had talked about that it is about the width of your pinkie finger or a pencil, because a centimeter is abstract to them. Once they estimated, they got a ruler and measured. I told them that the object was to have the estimate be as close to the actual measurement as possible. I said, 'You're trying to make a good estimate.' Most of them turned out fairly well. Then we're going to use that data and they're going to put it into spreadsheets. And then they are going to change that spreadsheet and they're going to put it into bar graphs. And they're going to make that bar graph look the best that it should look. For any kind of graph you're supposed to communicate without talking...have your title and your key so that if someone saw this, they would know exactly what you're trying to explain. So I'm going to go through it with them step by step and they each get a handout and it will go through it step by step for them and they just have to be able to follow the guidelines, basically. Then they can go back and play with the colors and the background of the bars and make it a little bit more unique. I'm trying to get them used to the idea of what you have to do to put a graph together and to present it well."*

"The first year I did it was last year. Graphs are found in math, science, social studies, language arts, and in magazines and books, so they have to be able to understand them. So I did it last year and they made bar graphs, line graphs, circle graphs. I asked them to tell me which one they thought was worst, and they said the pie graph—there was too much data and it can't graph all the data, it can only do one set of information. They said it was horrible. And so most of them thought the bar graph was the easiest to understand. I was hoping that they would be able to pick one good one and explain why, and they could. This year, a teacher who teaches 7th graders social studies [said that the students who had taken math with me in 6th grade were able to do the graphs in his class, commenting that he could tell which students had been in my class]. I was glad to see that they seemed to understand it better when they got to generate it for themselves on the computers."

"Then I felt comfortable enough the second year to actually do a big project and it was [a graphing activity]. I felt comfortable enough to teach them and they felt comfortable with it and they did fairly well on it. So we displayed it out in the hallways—all their bar graphs.... This year I'm going to take it a step further and have them write a paragraph to explain how they collected their data and then talk about were their estimates close...and how did that make them feel. Do they feel that they were good at estimating and so forth. On Friday, I'm going to give them magazine pictures and have them generate 10 word problems for each picture (2 adding, subtracting, multiplying, dividing problems and then see if they come up with 2 problems that involve fractions because fractions seem to be their biggest weakness). Using the computer to generate word problems so that maybe they won't feel so frightened, they can think, 'Oh, this is fun! No hand, pencil, paper stuff, it's all on the computer.'"

5.0 Technologies Involved [*types*]: *Check off technologies used.*

Y • Microcomputers
N • ILS
Y • Other LANs
Y • WANs
N • CD-ROM
Y • Interactive videodisc
N • Videocams and editing equipment
• Other

Y • Word processing
Y • Spreadsheet
N • Hypermedia
N • Animation
N • Simulation

Note:
J. A.'s classroom, like all other classrooms in South Creek, is equipped with six computers, a VCR and videodisc system, and a projection system for class presentations. Use of videodisc equipment was not described. J. A. schedules the computer lab for activities that involve extensive use of technology (allowing one computer for every student). Spreadsheet and word processing applications are the primary uses of the computers within J. A.'s classes.

6.0 Technology Use Classification and description of how technologies were used.

- Student Uses [*kIduse*]

  Tutorial ***[tutor]***

  J. A. mentions that she uses drill-and-practice math software to "build their skills up" and to "help them work a little faster." She feels that the game format is appealing to students, who are learning as they use the programs, even though they may think of it as a game. She feels that these programs are limited, however, in terms of student learning and in terms of integration with the curriculum. She would like to see more software that is tied specifically to teaching of the state-mandated "essential elements" for math.

- Exploratory ***[explore]***

  Not described.

- Communication ***[commtn]***

  Not described.

- Tool ***[tool]***

  Computers within J. A.'s classes are used primarily with spreadsheets and word processing applications. Students use spreadsheets to calculate, analyze, and present data. They experiment with various ways of presenting numerical information, through charts and graphs. They use word processor to create narratives to accompany their spreadsheets and graphs, and for other math activities, such as creating their own story problems.

- Teacher Uses **[*tchuse*]**

Communication

Teachers at South Creek communicate extensively with one another over the school's LAN. J. A. comments that the e-mail system enables teachers within teams to share important information about individual students—information that might otherwise be forgotten or that might not be as relevant or as useful if it were withheld until a face-to-face opportunity for dialogue between teachers arose. *"The e-mail is wonderful, because the whole concept behind a middle school is to be able to communicate and to try to have a core block of students going from teacher to teacher to teacher, and to have them in common with each other. So if I have a question about a child in my room...I can e-mail and find out who has them next, and say, 'Look, I've noticed something, I'm not sure if it's just me or they've had a bad day, but let me know what you think.' And we can get responses within minutes, they just e-mail us right back, and say, 'I noticed the same thing yesterday,' or 'I'll keep my eye open.'"*

J. A. is receiving training in the use of the state education network, to access teachers and resources across the district and in other communities over the WAN. She does not comment on her use of telecommunications to communicate with others outside of South Creek.

J. A., along with other teachers at South Creek, feels that the e-mail system increases the level of safety and security within the school. With their computers left on throughout the day, teachers are immediately notified by a "chime" when a message is received. Students help monitor this process, often checking the incoming message for the teacher. If the message is tagged "For Your Eyes Only," the teacher knows that this is a message that should be read as soon as possible. In this way, the e-mail system is used to notify teachers throughout the school of any situation that may be a security or a safety concern. J. A. comments that having this system in place increases teachers' sense of comfort and community. *"Also, because of where we're located, sometimes there are problems with violence, gang-oriented or otherwise. We've had a few notices that there were people in the area that should not have been in the area. The principal, or one of the assistant principals, can e-mail us, and within seconds we know that if we see anybody in the building that looks suspicious—if they've given* *us a description–we immediately know what to do.... On a couple of occasions they've let us know that someone was in the area, they've noticed them in the apartment buildings and stuff, and it has made us aware.... So we feel more comfortable. Otherwise, we wouldn't know what was going on, and we'd probably be upset knowing that there was somebody in the area and we weren't notified. With e-mail, in a minute we've got it. So we feel comfortable with that."*

Presentation

J. A. uses the projection systems within her classroom and the computer lab to walk students through software procedures (e.g., how to use a spreadsheet) step by step. She prepares slides outlining key points, as well as sample spreadsheets and graphs for students to use as models. Use of VCR and videodisc for presentation purposes is not addressed, although her classroom is equipped with these systems.

Instructional Management

South Creek has adopted an instructional management system (*Class Master*), which is used by all teachers in the school for attendance and grading. J. A. feels that this software increases her efficiency, and allows her to devote more time to substantive issues, such as curriculum planning. *"With the grade book it frees up a lot of our time to spend getting things ready for lessons, or looking for things to do in the classroom. Otherwise we'd be constantly creating papers, averaging, and stuff like that, and the computer does it for us. We just grade the papers and put it in, and it will weight it, average it, and everything. It frees us up a great deal."*

J. A. uses the software's capability to provide a range of information regarding individual and class performance. She feels that this information helps her identify areas of weakness in her students' understanding and mastery, as well as in her coverage of material. She shares information regarding class averages with her students, using this information as an impetus for higher achievement in much the same way as a coach would use past game scores to motivate team players to improve their future performance. *"I can take the information that the computer will generate and I can do different things with it. I can organize it in different ways to show me where there's a weakness, where the majority of my kids fall when there's an activity—the B range, the D range. If they fall low, was it me? It allows* *me to focus in on, was it me? Did I not teach it well enough for the kids or was it something that was beyond what I thought they could do?... So I can use the data that's generated by the computers for the grades and bring it down and look at it any way I want to. And that helps me. I tell the kids the class average was this, most of our grades fell in the A range or the B range. I never say 'you individually,' it's always 'we.' 'We averaged B and that's very good. We averaged C and that's not bad–it's average–but I think we could do better than that' ... [with the computer] it's easier to see in a blink of an eye, I can just segregate everything for me, I can have it without having to pencil and paper it...."*

7.0 Intended Benefits of Technology Use [*bene*] *Include any of the following:*

- Peer-to-peer collaboration

  Not addressed.

- Independent exploration

  Yes. J. A. believes that interactive programs and tools, such as spreadsheets, enable students to engage in independent exploration of subject matter. This is, she feels, in part due to the fact that students are more motivated to engage in independent work when they are at the computer. In addition, the computer can provide individualized feedback and an interactive environment that allows students to build on their explorations.

- Access to outside information resources

  Not addressed.

- Support for higher-level thinking

  Yes. J. A. believes that applications such as spreadsheets allow students to engage in a higher level of problem solving and task complexity than would otherwise be possible.

- Creativity

  Yes. J. A. feels that students are provided with many creative options within applications such as spreadsheets and word processing, particularly with respect to formatting and display.

- Technology skills

  Yes. J. A. feels that technology skills are essential to her students' future achievement and success in realms of both school and work.

8.0 Realized Benefits of Technology [*kidout*] *Include any of the following:*

- Motivation ***[motiv]***

  J. A. feels that technology is "absolutely" a motivator to her students. She believes that students enjoy their activities on the computer more than those with paper and pencil. She attributes this to the fact that the computer is interactive, that it makes a number of tasks easier or more accessible, and that students are able to take greater pride in their work because of the way that it looks when it has been produced on the computer. *"On the computer, it allows them to do things better and they feel more comfortable with it. We have kids that don't have good fine-motor skills and the computer makes it easier for them. Then they see it out on the walls, and their name is on it so that everyone can see it, and they're real happy about that. They're more apprehensive if they have to do it in pencil and paper and they have to do their own drawings...."*

  J. A. feels that students are attracted to some of the math drill-and-practice software because of its game format. She comments that students do not realize that they are working on their skills when they use this software, because it is so much fun. *"We have a lot of math programs on the computers...but it's mainly review and practice...so it will build their skills up, maybe help them work a little faster. And it's game format, which they like more...they don't think that learning is occurring. They think, 'Hey! It's a game. No learning is involved.' And far from it."*

- Attendance, time on task, discipline ***[kidbehav]***

  J. A. believes that having technology available as a tool has increased her students' interest in math-related activities. Computers also appear to extend what students are able to do in such a way that they are spending more time on particular tasks, and because they are interested and motivated, discipline becomes less of an issue. J. A. comments that she is able to do much more with graphs, for example, using the spreadsheet as a tool. Previous to using computers, graphing activities were often difficult and not very interesting to students. Students now appear to enjoy the activity and are better able to stay on task.

- Amount of collaboration and cooperative learning skills ***[cooplg]***

  Not addressed by J. A. During our observation, students were working in the computer lab, with each student at his or her own computer. As students worked on their spreadsheets and graphs, they provided one another with assistance and feedback. This activity was not structured as a collaborative activity, but it is clear that students took an interest in one another's work and that this interest was facilitated by the fact that they were able to easily see what their neighboring classmate was doing. Students appeared comfortable asking and providing one another with assistance at the computers as needed.

- Ability to manage own learning ***[selfreg]***

  Not addressed by J. A.

- Access to outside information resources ***[outinfo]***

  Not addressed by J. A.

- Support for higher-level thinking ***[higher]***

  The graphing activity described by J. A. and observed in her classroom is a complex and multifaceted activity that involves critical analysis and higher-level problem solving. The project provides students with a sophisticated introduction to the use of spreadsheets to calculate, analyze, compare and present quantitative data. After collecting their own estimated and actual measurements, students enter their data on a spreadsheet and explore various ways of representing their data in graphic form (graphs and charts). Students write a brief narrative at the word processor, describing their approach and their results in text. They engage in the problem solving process of determining what information to include and how to display it. Through this process, they are learning and comparing different ways of analyzing and representing information. J. A. comments that her previous students have explored a variety of graphing formats at the computer—pie graphs, line graphs, bar graphs—and that this experience enabled them to access the advantages and the disadvantages of each approach. For example, students found that pie graphs were often limited when "there was too much data and it can't graph all the data. It can only do one set of information." In summary, the use of spreadsheets has given students the opportunity to engage in higher-level thinking with respect to graphs at a variety of levels.

- Complexity of task students can accomplish ***[taskacc]***

  J. A. feels that the spreadsheet has enabled her students to engage in graphing activities that are much more complex than what her previous students were able to accomplish with paper and pencil. See *Higher-Level Thinking Skills* above.

- Learning on specific tasks ***[kidlearn]***

  J. A. believes that drill and practice software can improve students' mastery of math skills, as well as their speed in calculation and problem solving. She feels that tool applications, such as spreadsheets and word processors, can be integrated into the curriculum in ways that support students' learning of math concepts, skills, and tasks. Specifically, she has used the spreadsheet to help students gain a better understanding of graphs within math, as well as within other subject areas. Prior to using computers, J. A. reports that graphs were a particularly difficult concept for students to grasp. She feel that the process of collecting their own data, then entering these data on spreadsheets and exploring graphs and other forms of graphically displaying the data at the computer, has greatly aided her students' understanding. She reports that this activity has resulted in her students' stronger grasp of the purpose of graphs, as well as in their ability to create, critique, and interpret graphs. One 7th grade teacher told J. A. that he could tell which of his students had taken math with her in the 6th grade, because they were able to use graphs in his social studies class. J. A. feels that graphing is an important skill, since *"graphs are found in math, science, social studies, language arts, and in magazines and books, so [students] have to be able to understand them."*

- Creativity ***[create]***

  J. A. comments that students enjoy being creative in their construction of graphs, using formatting options with the spreadsheet to explore various ways to display their graphs (e.g., backgrounds, orientations, fonts).

- Greater attention to how a product will be understood by others ***[audience]***

  When introducing the spreadsheet/graphing activity to her students, J. A. addresses the importance of attending to how the graph will appear to others. She stresses the importance of designing and labelling graphs in such a way that they are interpretable. J. A. feels that spreadsheet graphing capabilities and functions provide students with the opportunity to explore a variety of ways of displaying their data, making it easier for them to consider and compare the features that can enhance the attractiveness and the interpretability of their graphs.

- Technology skills ***[hackskl]***

  J. A. reports that her students "soak up" technology, learning procedures and mastering skills, often more quickly than she. She comments that, especially in her first year at South Creek, she has learned alongside her students, sometimes asking for their assistance. South Creek students are given extensive access to technology, using word processors, spreadsheets, and telecommunications tools, as well as supplementary tutorial software, in many of their classes. In this context, they learn to master technology as a tool to accomplish a wide range of tasks. J. A. feels that the Macintosh platform was a particularly good choice, given the consistency across programs and its "user friendliness." J. A. feels that the technology skills and concepts that her students are acquiring at South Creek will give them a needed edge in high school and as they enter the world of work.

- Self-esteem

  J. A. feels that technology mastery provides students–especially those from disadvantaged backgrounds—with a source of pride and self-esteem. *"I think it gives them more self-esteem. I think they assume that since they may not have as much money or they may not live in a home, they're not smart enough to use technology, which is far from it. And given the opportunity, they can do just as well as any other kids. But most of these kids probably haven't been given the opportunity. They don't have the money to have computers at home. Whereas I came from a school where most of the families could afford a computer and used it and felt comfortable with it and the kids that didn't...had the tendency to withdraw and put their heads down and not really want to be into anything technology based because they were afraid. They thought, 'Oh, I can't do it because I don't have one.' And these kids here just soak it up. They just love going to the computers when they get the chance. So I think it helps their self-esteem. I think they realize it has nothing to do with their intelligence level or their background, being wealthy or not, they can still do their work given the opportunity. So I think it makes them feel better about themselves and smarter."*

- Obstacles to implementation

  J. A. laments the fact that students will not have access to technology in high school to the extent that they do at South Creek. She feels that this will limit students in their ability to build upon the skills and knowledge that they have acquired in middle school. She notes that lack of funds is the primary barrier to the district's creation of a technology-infused high school. In addition, the lack of funds prevents South Creek from updating its equipment and expanding its uses of technology through state-of-the art programs and applications.

"The majority of our kids go to the high school and it is not as technology based as we are. That's the only drawback, I think, of the system. We have a wonderful school. I just wish that once our kids left here, they went to another school like it. I wish we had the funds to do this with every school, but it's a big investment. So if we had some sponsors...that would help tremendously.... We had some partners in education, we've been trying to get the funds for it, but when you're talking about a school at this scale, you're talking millions and millions of dollars and we're constantly trying to get updated. Because as soon as you get the computers, you're outdated. Boom! Something else comes out. So we are constantly buying new programs or upgrading our computer systems and it's getting harder to get the funds. You know, 'Well, we just gave you this.' And, yes, we're appreciative, but now we want to take it a step further, because our kids have done well with it and we want them to go further with it. So it's the funds, mainly."

J. A. feels that there is a need for more software applications, such as spreadsheets, that can be flexibly integrated into the curriculum.

"Many of the programs that we have in math are review-and-practice-type things, they're in game format, which is fine, but we need more programs that would be built into the curriculum. Instead of having to teach it the old-fashioned way, we need something for the computer. And just put it on the computer, and see how that can be taught to the kids and see how well they accept it that way. And if they learn it better on the computer—allow them. We would just sort of be a helper if they didn't understand. We would just stand back and watch and see how the learning proceeded. So that's the main concern I have. We have a lot of math programs on the computers...but it's mainly review and practice...so it will build their skills up, maybe help them work a little faster . . . . So I wish we could have more programs that were tied into our curriculum or the state essential elements."

TEACHERNET DEBRIEFING

Sites:	Eisenhower High School Maple Glen Middle School Green Hills High School
Contact:	W.T., Executive Director, Omni Educational Institute

1.0 Summary

> *Our particular philosophy at [the education institute] is that when there's a need to know, then people will take in what they need to know, and it's a matter of sustaining them until they have another need to know something else, and as long as you keep creating and you keep moving things and you bring the teachers in palatable bites, then it just kind of seems to continue to grow. Because the applications are real, they see the value. And that's the philosophy under which this whole thing has been developed.* (W.T., Executive Director, Omni Educational Institute)

Teachernet is a not-for-profit collaborative partnership among school districts, university systems, business, and community agencies that uses technology as a vehicle for educational reform. It encompasses 54 districts in a 10-county area in the Midwest. Since its inception in 1987, Teachernet has been governed by school superintendents and managed by Omni Educational Institute (OEI), a not-for-profit educational services agency.

Teachernet's mission is to advance teaching and learning through partnerships with educators, business, and government, and to provide a global information system.[1] To accomplish its mission, Teachernet facilitates communication, cooperation, and collaboration among teachers, students, administrators, support staff, and parents through the support and expertise of institutions of higher education, business, government, and other entities.

The centerpiece of Teachernet's educational reform initiatives is the Teachernet Telecommunications System (TTS), which provides participating members with access to electronic communications, a curriculum library, news and information, reference/research sources, and access to the Internet. Teachernet also sponsors the new Scholars Program, which uses technology and cooperative learning as strategies for addressing desegregation. In addition, Teachernet partners are currently formulating Teachernet 2000, a restructuring initiative based on the use of technology. Teachernet 2000 will require extensive teacher training, and changes in classroom management and instructional methodologies.

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[1] The Teachernet Plan, October 1993.

Please note: For the purposes of this case study report, Teachernet will be considered the "school." However, many of the headings used in the school debriefing form are not applicable here, as noted.

2.0 Context and Reform Overview

2.1 Educational Context

- Setting
  Teachernet is "located" in each classroom, teacher's office, administrator's office, partner's office, and home that is connected to the TTS. Including only the K-12 education partners, this translates to 54 school districts, 462 K-12 schools (serving 250,000 students), and 18,000 teachers. Because the setting of Teachernet is somewhere in cyberspace, we will describe, instead, the setting of OEI that serves as the physical hub of the Teachernet Association.

  Under the guise of a small storefront in the quiet business section of a midwestern city, OEI is actually a hotbed of technology-inspired educational reform. Directed by W.T., the not-for-profit agency has been providing educational technical assistance, consultation, and training in the metropolitan area for over 15 years. Its eight professional staff, including a retired superintendent and a teacher on leave, bring a diverse range of skills to the agency's services.

  OEI's executive director estimated that approximately 90% of OEI's efforts now are focused on managing Teachernet. The other 10% of their efforts are dedicated to training teachers; program design; grant writing; program marketing; program coordination; and forming liaisons with universities, businesses, and the community.

- Grade Levels

  250,000 K-12 students have access to Teachernet.

2.2 Demographic Information

Although all the districts and schools that participate in Teachernet are within the 10-county metropolitan area, they vary greatly with respect to wealth, size, and demographics. The largest of the 54 districts serves 35,000 students (down from 75,000 when Teachernet began); the smallest serves 127 students.

According to W.T., the metroplex is relatively high tech—one in every four homes has a computer.

2.3 Education Indicators

Given the scope of Teachernet's membership, it is very difficult to provide valid comparative measures of educational indicators. Ideally, one would want to compare Teachernet district scores on an achievement measure that is used across all districts in both states to those of matching districts (i.e., districts with similar demographic characteristics). Alternatively, if the states, or districts within states, used different achievement measures, one could compare changes over some time period (e.g., before, after participation in Teachernet) across the Teachernet districts. Since such data were not available to us, we reviewed a recent article in the local newspaper, which presented ACT scores of students in the two states. State "A" ranks above the national average (21.7 compared to 20.7), while State "B" is nearly identical to the national average (20.5). Unfortunately, we have no data about the standing of Teachernet districts within these states.

2.4 Reform History

Prompted by such publications as *A Nation at Risk*, educators in the metroplex were well aware that the teaching and learning of mathematics and sciences had to improve and that curriculum in these areas, as well as in health, had to be revamped. Many of the area's districts had started to address some aspects of these needs, but their efforts were underfunded, uninformed, and uncoordinated. OEI, which had been working with local districts since 1979, was familiar with most of the districts and had developed trusting relationships with them. They were also aware that the various reform efforts underway locally could benefit from collaboration. Thus, OEI took the lead in convening a meeting of school superintendents in 1987 to talk about the need for reform.

3.0 History of Tech Applications

3.1 Incentive for Technology Use

The incentive for technology use in the case of Teachernet was really an incentive to collaborate. After the first meeting that OEI convened with superintendents to address reform issues, the group realized that they had to look at ways they could share resources, especially around math, science, and health, if they were going to make any serious progress in reforming their school systems. W.T. remembers:

> *We went so far as trying to figure out a way that we could share resources in terms of maybe buying big trucks and transporting heavy science equipment from school to school, and very quickly began to realize that this was not anything that could be sustained over a long period of time. So what were some other ways that we could do things?...We decided at that point that one of the things we needed to look at was technology, because technology through networking was one of the ways we could share resources, and that seemed to be the most logical way to employ those tools to the benefit of all, and we were very interested in providing students equity of access. And so, with those things in mind, that's how we began to develop [Teachernet].*

3.2 When and How Application Started

The first meeting of the superintendents who were to become the Teachernet Association's first board members was in 1987. W.T. describes this core group as "risk takers"' because, historically, the school districts in the area had not worked well together and most of the superintendents didn't know one another. The original Board of Governors (14 superintendents and W.T.) created bylaws that regulated the process of putting resources in Teachernet and accessing Teachernet's pool of resources. Many lawyers were involved because of co-ownership issues. It took 18 months for their "cooperative management team" to set up the process of contributing/using resources.

OEI was charged with managing the Teachernet budget and putting a cooperative technology model in place. OEI decided that accessing technology via a network was the best direction to go. The network concept was especially well suited to ensuring equity of access across schools of disparate socioeconomic levels. After examining many options, OEI recommended *Delphi* as the common carrier. Their bundled services modem allowed hooking schools into it. It was cost-effective, and it was the only service that would charge a flat rate (rather than time on-line), which was one of the most difficult aspects of the agreement to negotiate. Additionally, Delphi could handle the diversity of computer systems across the 54 districts and 450 schools.

Once the carrier was identified, the next step was getting computers for the schools. Each of the districts had different resources, needs, and equipment. Each school that was involved needed four elements—a computer, a printer, a modem, and a phone line—and was required to identify someone to act as a technology contact. This role was filled by various types of school staff across districts.

Two years into the development of Teachernet, OEI realized that teacher input was needed. So, they established a Blue Ribbon Committee of teachers. These Blue Ribbon Committees have since expanded to include a number of substantively focused committees.

During the summer of 1991, the Teachernet Association engaged in strategic planning with representative resource partners: Marion Merrell Dow, a technology Association, a state university, and OEI. Teachernet now has a formal set of goals, which include the following:

- Promote the improvement of education through cooperative alliances among schools, colleges and universities.
- Obtain AMERICA 2000 status.
- Offer an interactive resource network.
- Assist educators in the use of technology.
- Advance the instructional strategies of teachers.

- Provide for relevant, technology-enhanced curricula in health, science, and mathematics.

They have developed strategies for meeting these goals in a 5-Year Plan. Teachernet has ambitious plans for the future, which are summarized in Section 7.2.

3.3 Technologies Used

X	Microcomputers	X	Word processing
	Integrated Learning Systems		Spreadsheet
X	Other LANs		Hypermedia
	WANs		Animation
X	CD-ROM		Simulation
	Interactive videodisc		
	Videocams and editing equipment		
X	Other: Modems		
X	Other: Phone lines		
X	Other: Serial interface cards		
		X	Communications software

Overview of the Teachernet Telecommunications System (TTS)

The TTS includes eight primary applications:

1. **Communications:** Includes e-mail that teachers and Teachernet partners have access to. Student use is not widespread because user names are limited to just a few per school.
2. **Curriculum Library:** Includes: health, mathematics K-4, mathematics 5-8, mathematics 9-12, primary science K-2, intermediate science 3-5, middle school science 6-8, and high school science 9-12. Many curriculum databases are available through Teachernet. For example, "Family Life/Sex Education" for health, "Reasoning" for K-4 math, "Trigonometry" for high school math, and "Human Organisms" for intermediate science.
3. **Information News**: The Information News component allows access to UPI news, which opens up national news, international news, business and finance, sports news, etc.

4. **Reference/Research:** Includes DIALOG, which links the user to hundreds of databases in agriculture, biosciences, books, business information, economics, medicine, psychology, and magazines, to name just a few. *Grolier's Encyclopedia* is included, as are HealthNet, Public Television, area university libraries, and, of course, Internet services. The Internet is a global communications network consisting of more than 6,000 individual networks spread over 40 countries. Internet users can use the Internet e-mail and Telnet, which allow electronic communication with others in remote locations and access to programs and data stored on millions of computers around the world through the use of search tools like Gopher, WAIS, archie, veronica, and World Wide Web. With file transfer protocol (FTP) software, users can obtain resources from all sorts of different computers on the Internet.
5. **Quincentenary**: Includes announcements, conference information, and miscellaneous other information relating to the 500th anniversary of Columbus's first voyage to the New World.
6. **Teachernet Services**: Includes various guides to the area, resource directories, and travel reservations.
7. **Support Materials**: Applications, forms, evaluation, and other materials.
8. **User Guide to Teachernet**: Provides instructions, workspace, and a help feature.

Within the metroplex, all the districts can call locally and access the information Teachernet puts together. Each participating district and school has modem bank access to the bundled services on Teachernet. Access to these services is limited, however, by equipment constraints. The high schools have about seven phone lines each, which is not adequate for their needs. The lower-level schools have even fewer. Each school has only a few user names, which limits the use of e-mail considerably.

3.4 Target Grades and Curricula

Two hundred and fifty thousand K-12 students have access to Teachernet. A wide variety of curriculum areas are included in the TTS, including: health, K-4 mathematics, 5-8 mathematics, 9-12 mathematics, primary science, intermediate science, middle school science, and high school science. Each of the 8 Blue

Ribbon Committees that provide advice and technical assistance to Teachernet has a specific substantive focus—science and technology, comprehensive health education, mathematics, humanities, environment, the Chemists Project, the Scholars Program, and the library.

3.5 Key School Players

Given the systemic nature of Teachernet, we include as "key school players" OEI and all local educational partners. The one person most responsible for Teachernet is W.T. It was she who took the initiative in bringing the original set of superintendents together "on neutral territory" to discuss ways in which they could work together to address the area's need for educational reform. These superintendents had never worked together in a collaborative manner before. She described her facilitative role thus:

> *And I really must say that I felt like the hostess at some kind of a meeting every time we had these get togethers because the superintendents didn't know each other. They had never worked together before.*

W.T. had worked with many of them before, however, and had done some work in the area of educational technology. She had written a program on mathematics for a computer group and she said OEI was instrumental in bring some of the first computers to the schools as a way to promote math and science instruction.

She and her staff at OEI continue to play a very important role for Teachernet in recruiting new partners, negotiating with vendors for technical services, writing proposals for new funding (for both Teachernet and participating districts and schools), disseminating information about Teachernet such as the Teachernet User News and brochures on Teachernet programs and services, making presentations at professional conferences about Teachernet as it relates to educational reform, and finally, training teachers in the use of technology for educational purposes (see Section 5.2 for more on the nature of OEI teacher training).

In describing the history of Teachernet, W.T. noted that OEI had always worked with teachers and they began to bring in a cadre of some of these teachers to begin to help develop Teachernet. She asked them: "What are the issues in schools? What do you really need? What do you really want?" Over time they began to call these teachers Blue Ribbon Committees. Today, Teachernet has eight Blue Ribbon Committees: (1) science and technology, (2) comprehensive health education, (3) mathematics (which will soon be merged with the science and technology committee), (4) humanities, (5) environment, (6) the Chemists Project, (7) the Scholars Program, and (8) library. Each committee is coordinated by a staff person from OEI.

Superintendents also played an important role in the development of Teachernet and continue to govern the Teachernet association. Two superintendents serve as co-chairs and 12 others, along with W.T., comprise the Board of Directors.

There are many administrators involved from local district and schools. One with whom we became familiar was R.D., the assistant superintendent of a school district in State "B" where we visited.[2] He has recently been very involved in making the state commissioner aware of the need for schools to have direct connects (rather than modem connections). He supported Eisenhower High School in developing an innovative technology course, electronic research, and in forming a technology committee which set the stage for a district technology committee.

Several of the teachers on the Eisenhower technology committee were singled out by others as playing a key role in the technology program at Eisenhower: R.L., who designed and teaches the electronic research class; C.A., who uses the Internet for classroom applications in social studies and has been a lead writer on a number of federal and state technology grants and efforts; and M.T., who was instrumental in implementing the Scholars Program.

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[2] Citing the names and roles of particular school staff is not meant to imply that they are the only school staff who played or play a key role in Teachernet. We were most familiar with them because of our site visit there.

3.6 Outside Players in Technology Application

- District involvement

  Note: District staff are considered School Players for the purpose of this case study report.

- State involvement

  The regional education network works cooperatively with the state department of elementary and secondary education to provide connectivity to Teachernet throughout the state. Another way that the department of education of State "B" has supported Teachernet is by funding teacher training in technology through incentive grants. Through this source of funding, the Eisenhower technology committee was able to train over half of the teachers in the high school.

  The department of education for State "A" partnered with the Teachernet Association to provide a cost efficient method for rural school districts to get full Internet access. The services that Teachernet has bundled are combined with reduced cost dial-up access and provided throughout the state.

- Business involvement

  Representatives of business have been involved in the development of Teachernet since its inception. The following firms are currently business partners: Allied Signal, AT&T, Boatmen's, Marion Merrell Dow, Microsoft, Olin Environmental, Science Pioneers, Southwestern Bell, and Sprint. Representatives of this group helped develop Teachernet's strategic plan in 1993.

- Foundation involvement

  The Victor E. Speas Foundation provided initial grant funding for the TTS and for development of curriculum modules in health education which will be put on the network. The National Fish & Wildlife Foundation is a Teachernet resource partner.

- Parent involvement
  Several teachers noted that parents are very supportive of their children's' access to and use of Teachernet. One parent we spoke with, who was a special education teacher on the Eisenhower technology committee, helped to implement Teachernet's Scholars Program. Teachernet is developing a family network, which will likely lead to more direct parent involvement and interest in Teachernet.

- Other outside influences, including research
  Six area institutions of higher education are partners in Teachernet, including two private colleges, a state university in a neighboring state, the University of State "B" at two city sites, and the University of State "A." A number of educational, social service, environmental, and health organizations are also partners with Teachernet. Several national laboratories, including Lawrence Livermore National Laboratory and Lawrence Berkeley Laboratories, have worked with Teachernet. Many health and safety groups are part of Teachernet as are individual health practitioners.

  Taken together, Teachernet has generated the support of 50 resource partners, nearly as many as there are participating school districts.

4.0 Overview of Tech Uses

The following information is based on student and teacher use at Eisenhower High School, which is considered a high-utilization school relative to other schools in Teachernet.

4.1 Student Uses

- Tutorial
  There was no evidence that Teachernet is used as a tutorial device.

- Exploratory/Tool for Accessing Information
  Teachernet is used by students primarily as a way to explore databases and access information electronically. R.L., a member of Eisenhower's technology

committee developed an electronic research course to teach research using technology. He said that he concentrates on the things the students are going to use the most. The technologies involved range from library automation systems, through CD-ROM applications, to services and resources offered through the Internet. After exposure to a variety of electronic research tools, such as Dialog searches and Veronica searches with Gopher on the Internet, students practice using the tools to collect, analyze and synthesize information pertaining to thematic projects in four areas: student rights, habitats, pollution, and AIDS research. For example, students worked in groups of two or three to search Supreme Court decisions regarding student rights. After finding three, they wrote and presented position papers which were discussed in roundtables afterwards. Another project involved colonizing a planetary object of the student's choice. They used the Internet to search for information on their planet and download gifs (i.e., graphic interface formats), such as images of Jupiter's moon. Using all these data, they wrote reports about how they would colonize the planet.

Students in C.A.'s social studies class use Teachernet to access the CIA fact book—rather than rely on textbooks—to collect up-to-date information for class assignments. According to C.A., "Kids get so excited just with anything you do that you connect!"

Debate students have access to Dialog for researching databases relevant to debate topics. Through Dialog, they can gather information form over 100 newspapers, 200 journals, industry publications, Associated Press, and UPI.

We interviewed ten students who were enrolled in the electronic research class. As a group, they were generally excited by the on-line opportunities available through Teachernet. Each felt strongly that the amount of information available on the Internet is incredible, and that having access helps them tremendously with the type of research they do for school. There was general consensus that computer searches are much easier, more efficient, and yield more timely information than library searches. They found the network especially helpful for obtaining up-to-the-minute information, such as news updates off the UPI news wires, or current magazine articles. But they were disappointed with the amount of time it takes to download files onto the school's system using Teachernet and they complained that the school did not have enough modems to accommodate their need to access the system.

Some students have become so accustomed to the network that working without it can be painful. One student describing her first experience doing a research paper without it said:

> *I had writer's cramp. I had a stack of books on my desk, little tab markers in each of the books, and I was just furious. I wanted access on one of the computers.*

- Communication

  Eisenhower High School students' use of e-mail is limited to the electronic research class and other computer classes. This is due to the fact that the entire school shares one e-mail address (with the exception of two members of the technology committee who have their own). Students with access to e-mail can be involved in Keypals and develop e-mail relationships with students from anywhere in the world. They can also communicate electronically with the president or vice president.

  A few of the students in our focus group mentioned direct e-mail experiences that they have had. One student reported that she communicates regularly with a man in Luxembourg. Almost all of the students seem familiar with e-mail and on-line communication even though some did not mention any direct experiences.

- Other:

  (1) Strategy to promote desegregation

  One of Teachernet's showpiece projects is the Scholars Program, which was designed by OEI and others as an alternative to traditional desegregation strategies. Using Teachernet, it electronically links students from two middle schools. One school is located in the heart of the city and is almost entirely black; the other is in a rural area of State "A" and is entirely white. Students use Teachernet to work collaboratively in small groups with students from their partner school. Tasks for the student groups will focus on metropolitan problem solving. To accommodate the program, the schools changed their class schedules to allow students longer periods of time on Teachernet. The two-year pilot program, which was in its first year when we visited, involves the entire school population of 6th graders from both schools. These students will be allowed to continue in the program until they graduate from high school at which time they will be given $2,000 toward a community college degree.

4.2 Teacher Uses

Teachers who are involved in Teachernet have access 24 hours a day all year, both at school and at home, if they own their own computer. According to W.T., use surveys show that a lot of on-line time is done in the evenings.

- Communication

  Like students, it did not appear that Teachernet was used by the majority of teachers who had access to the system for the purpose of communication. As noted above, the fact that schools are limited to just a few user addresses has made individual use of e-mail less attractive. All messages are available for anyone to read and subscription to lists (i.e., connections to special interest groups) are not practical. Several of the teachers that we spoke with recognized the potential that e-mail has for changing the nature of teaching. C.A. said:

  > *I don't know of any other profession in the world that isolates themselves more from what others do than teachers. We walk into our classroom. We close the door, and there is no connection with the rest of the world. Networking is going to change that.*

  Besides the fact that teachers cannot have their own e-mail address, many teachers have not yet been trained in its use, according to K.M., principal of Eisenhower High School. Furthermore, he thought that training may be premature because "they're just not ready for [e-mail]." "They're still in the mindset of going to their mailbox in the office in order to leave or get a message."

It was noted by OEI staff that much of the curricula that comprises the Teachernet library was the result of collaborative work between teachers on e-mail.

It appears then, that until access is broadened and more training is provided, only the most sophisticated technology users will take advantage of Teachernet for the purpose of communication.

- Presentation

  Teachers use Teachernet in a presentation mode only when demonstrating a tool (e.g., showing how a Dialog search is done) prior to students' use of the tool.

- Instructional Management

  Although many of the teachers used computers to calculate and store grades, and to organize their letters of recommendations for students, none used Teachernet for this purpose because of security issues.

- Other

(1) Using the Internet for accessing information to enhance instruction.

The Teachernet contains a wealth of information available to teachers for use in instruction. To illustrate the diversity of information, the December 1993 issue of *The Teachernet Users News* describes three specialized networks for teachers: one contains information about AIDS; another is sponsored by NASA and includes questions to and answers by NASA scientists, and an interactive program for teachers and students that features a weekly report from NASA's project in Antarctica; the third is sponsored by a state department of education and contains a complete copy of President Clinton's health care legislation.

In addition to the sheer diversity of information available through the networks, an important feature of information from computer networks, as opposed to other sources, is that it is current. Eisenhower's principal underlined the importance of both of these features:

> *I think just the availability of all the different resources, Dialog in particular, to access all the different databases, and as people*

> *have more text articles, it's really a help to the teachers because they get to bring things in and share them with their classes. Today, information comes on the computer. Instead of information that's 2, 3, 4, or 5 years old, they know they can go right to the computer and get the most current, up-do-date information. I have had endless numbers of teachers come to me and say, "I am such a better teacher now. I have access to current information; I got it at home last night."*

For the most part, information from computer networks is used by teachers to supplement what they are doing in their classrooms. For example, a social studies teacher downloads current Supreme Court decisions to use as the basis of class discussions, while a business teacher tracks stock and bond prices. A math teacher used the World Series to engage students in an exciting math exercise.

(2) Using the Teachernet Curriculum Library as a curriculum resource

One component of the TTS is the Curriculum Library (see Section 3.3 above). Some teachers have found the curricula available on Teachernet to be helpful in some instances. But others say the lessons are too generic, not tailored to the state's or district's specific circumstances, and not aligned with other parts of the instructional system (e.g., other parts of the curriculum or assessment). The principal was looking forward to the day when his district will have its own file server for curricula so that all teachers will be able to access lesson plans that had worked in the district. District teachers will then put any lessons they consider good in a file folder for that particular subject, and other teachers will access the lessons as needed. As one teacher expressed,

> *If we can develop a bank of resources of lessons that are powerful and if they are tied to our state frameworks, we're going to have it made.*

(3) As a vehicle for collaboration

Teachernet is being used in the Scholars Program to promote teaming among teachers within and across schools. We observed a program training (provided by OEI for Teachernet) that purposefully mixed teachers from the two districts on small teams. The teams worked together on the same types of tasks that they would be giving to their students in the program.

The curriculum that is available on Teachernet's curriculum library is the product of collaborative work among teachers on various Blue Ribbon committees.

Some teachers are interested in seeking out others to collaborate with through Teachernet. For example, a special education teacher indicated that, because her class is so small, she is not able to form more than two small groups from her students. She feels this is problematic, because of the serendipity that occurs when information sharing takes place across a larger number of groups. To overcome this problem, she'd like to team with another teacher to share a project and have students in the two (or more) classes work together.

> *For example, like in science, having them do some kind of a research project together and collecting data and coming up with their conclusions or theories and seeing, I guess comparing, the classes, and then letting them share their information to see what kinds of differences they get.*

Although she met a colleague through an Internet Dialog training who expressed an interest in this type of collaboration, the collaboration is currently not feasible because he does not have sufficient hardware.

(4) As a way to receive inservice

Although it is not used in this capacity currently, a social studies teacher noted that Teachernet would be a very effective vehicle for providing inservice in specific content areas. He noted that his department had not hired a new social studies teacher in almost 20 years, and that he felt that the teachers in his department were out of touch with current teaching methods. He saw on-line staff development, possibly through one of the local universities, as a way for teachers to keep current.

5.0 Implementation Details

5.1 Problems Encountered

- Difficulties in selecting hardware/software
  No. Although the schools and districts that participated in Teachernet had different types of computers (including, according to W.T., Apple IIes, the old 64 Commodores and trash "from the '80s"), the common carrier OEI selected, Delphi, could accommodate the diversity. Delphi was an easy choice because they were the only company that would deal with Teachernet on a flat-rate basis. Other carriers wanted to charge Teachernet for time on-line which would have been extremely expensive in an educational setting.

- Difficulties obtaining hardware/software
  Yes. Teachernet districts and schools need more modems and phone lines or some other technology, such as a wireless direct connect, to ensure that teachers and students have adequate access to Teachernet. This is the most serious problem facing Teachernet—and it was cited by nearly every student, teacher, and administrator we spoke with. As it stands now (May, 1994), each district and school has modem bank access to Teachernet through phone lines. The problem is that there are not enough phone lines or modems to accommodate the schools' needs. Consequently, students and teachers frequently cannot get on the system, sometimes for hours at a time. It would not be "difficult" to obtain more modems or phone lines, but it would be prohibitively expensive. Local districts do not have state phone rates. They pay more than $50 per month.

  One teacher pointed out that his school has a staff of almost 100 professionals and a student body of 1,400 and they have only 8 phone lines. He claimed that nearly every time he tried to use one of the phones, "all the little red lights would be on, you can't call out, you can't call in. We just don't have enough phone lines and we can't afford to keep buying more." This teacher, who is on the technology committee, worries that access problems frighten many teachers who are already technology shy. "They're nervous about it."

One of the teachers we spoke with who had been trained to use Teachernet, but was not an experienced user, said that she couldn't practice her network skills because her classroom had no phone line. She said:

> *When I get more access I will use it more. When my access is so limited, it doesn't make sense to spend the time getting into it because Internet changes almost every day.*

- Difficulties maintaining systems

  No. Other than the usual level of equipment failure, it did not appear that Teachernet users had difficulties maintaining their systems. This is most likely due to the fact that they have access to a Help Line though OEI that is staffed with competent technology consultants who are familiar with issues teachers face in the classroom.

- Theft/vandalism

  No. There was no evidence that the districts or schools experienced an unusual level of theft or vandalism. We heard from some of the students who participated in our focus group, that student pranks were an issue. Some students felt that pranks were harmless, others felt that pranks indicated disrespect for the equipment.

- Teacher lack of knowledge/fear

  Yes. We saw several different manifestations of this issue. Some teachers just had not received any training on the system and so had no interest in picking it up. Others were interested and had some background in computers, but lacked knowledge of networking and using modems. Others worried that using Teachernet in their classrooms would make demands on them beyond what they were accustomed to (probably true!), especially in terms of their time. A district administrator described such teachers, "'If I don't use technology, then I don't have to do that." And he pointed out that that is a real safe place to be because they've been successful teachers.

  Still others had developed negative attitudes towards technology because 4 years ago the teachers were required to take 3 hours of programming class. And many teachers were concerned that Teachernet access problems along with the usual types of equipment failure would be too much for them to handle. They would rather know exactly what they are going to teach and how long it will take.

Other teachers simply do not have the patience to bear with the technology long enough to learn to use it. According to one of the trainers on the technology committee:

> *A lot of teachers have a hard time going through the frustration part. And that's what I'm encountering with teachers now. They'll get some training and they will do it in class and then three weeks later I'll say, 'Have you done any, have you logged into the Internet at all?' I haven't been able to do that.' They've lost it."*

OEI staff said that they had to overcome a lot of negative attitudes towards technology on the part of many teachers and some superintendents who joined Teachernet in the later years.

- Lack of time for learning to use technology or developing technology-related curriculum units

  Yes. Not enough time always seems to be an issue for teachers and learning to use Teachernet is no exception. OEI offers a variety of Teachernet classes (see Section 5.2), but some teachers complain that the course schedule demands too much of their evenings or weekend time. To get around this issue, the technology committee at Eisenhower tries to arrange release time for teachers to learn to use Teachernet at the school site. But even that solution presented problems—it was disruptive and stressful to use subs.

- Disappointing results from using technology

  No. There was no evidence that students, teachers, administrators, or Teachernet partners were disappointed in results obtained from using Teachernet thus far.

- Poor alignment of technology w/instructional goals

  No. Teachernet is generic enough that it fits in well with virtually any instructional goal K-12.

- Lack of funds

  Yes. Although Teachernet has been highly proactive and successful in obtaining funding, they do not have enough to support adequate access to the TTS for all schools and classrooms. To address this issue, they could purchase additional modems and phone lines, which would be very expensive, or they could invest in a wireless direct connect. See Section 7.2 for more information on the direct connect alternative.

- Resentment from nonparticipating classes/schools

  No. All schools that belong to districts in Teachernet have access to Teachernet. However, the computers, phone lines, and printers are generally available only in specific classrooms or offices. We did not discern any resentment from either teachers or students with respect to the location of the technology for Teachernet. However, we did not interview teachers who were not involved with Teachernet in some way. Neither did we interview school staff from nonparticipating districts or schools. It is unlikely that they would have any resentment about not participating since all districts in State "A" and State "B," including private schools, may become members.

- Lack of technical support

  No with respect to day-to-day teacher or student use issues. OEI provides a help line so that teachers can call in with any type of problem or question relating to Teachernet. See Section 5.3 for more information on OEI technical assistance to Teachernet participants.

  Yes with respect to high-level network expertise. As one of the teachers on the Eisenhower technology committee put it,

  > *I see that (not having access to consultants with network expertise) as one of the biggest networking roadblocks. We don't have the user's manual. Here is how a school district with a bunch of untrained people can build a local area network and do it without spending a small fortune...We don't have the time and we don't have the money to pay for the expertise because the people who are network specialists are getting big bucks working for companies that can afford to pay them, doing stuff that nobody can do...These people are not going to work for a teacher's salary and we can't afford them.*

K.M., the Eisenhower principal, reiterated this point. "We have no one to talk to about networking." When asked whether OEI could help with these types of networking issues, he responded, "OEI moves too slow for us."

- Failure to see fast positive effects on test scores

  Does not apply. There have been no expectations on the part of Teachernet districts, schools, teachers, or parents that access to Teachernet would result in higher test scores. All of the district staff and teachers we interviewed saw the primary benefit of Teachernet as giving students information gathering skills, decision-making skills, and problem-solving skills.

- Other problems

(1) Underutilization of Teachernet by some participating districts.

Participation in Teachernet does not necessarily lead to teacher use or student use of the system. We became aware of this issue though our exposure to Green Hills District that contracts with an outside firm for networking services (DRA) for their library media program. Teachernet, which they have access to, would have allowed them to do the same things and other districts would have benefited from access to the automated library system. Aside from the fact that Green Hills has elected to spend resources on an outside networking service, their use of Teachernet as an instructional tool has been very limited. We were able to observe one instance of teacher/student Teachernet use, but that was the first time teachers or students had had direct access to the TTS for instructional purposes. The teacher whose class we observed using Teachernet learned about the network through a professional conference.

R.L., who teaches the electronic research class at Eisenhower High School, agreed with our observation that while access to Teachernet seems to be more or less the same for partner districts, the way the network is used varies greatly. His explanation for this was that some school staff (he mentioned librarians in particular) "hide Teachernet computers and phone lines in a corner. They don't tell anybody else about them, so that they have the only access." He and another teacher on the Eisenhower technology committee said that they tried to address this problem by going out and doing a presentation for librarians to tell them how Teachernet can be use to promote better teaching and learning.

Since there are no sanctions or rules about how Teachernet should be used, districts and schools tend to use them in ways they know how, which often means as part of the library system. This circumvents the need to provide training to teachers in using technology for instructional purpose, which some districts may view as expensive and disruptive.

(2) Potential abuse of Teachernet

Several teachers, parents, and students are concerned that access to the Internet via Teachernet could expose students to material that does not belong in school. The school librarian feels that there are tremendous risks involved.

> *There is so much stuff out there. There's information on pedophiles, pornography is rampant out there, and there is information on how to build bombs and how to kill someone without getting caught.*

C.A., who is on the technology committee, noted that Teachernet will not support Usenet on the system because "there are some very inappropriate places in Usenet...It has some of the really, really, inappropriate user group things." But he points out that ironically, it also has excellent K-12 resources. He commented that Internet is an anarchy. "Its the biggest collection of people without anyone in charge. Also, you get these strange mixes: right next to K-12 you got pedophiles and you say, 'Oh, man, we don't want those two close together.'" See Section 5.2 for the school's solution to this problem.

5.2 Strategies for Overcoming Barriers

- Inservice training/release time

  Yes. Teachers who teach in districts that belong to Teachernet may receive excellent training from OEI. OEI sponsors a variety of teacher training which is oriented not so much to the technology per se, but to the use of technology in instruction. Specifically, OEI strives to train teachers to use Teachernet in ways that develop student reasoning strategies so that their students can better access, organize, and integrate diverse sources of information to solve intellectual challenges and accomplish complex tasks. The training is designed around teachers' needs and use. W.T. pointed out:

> *What we've basically done is tried to make the technology opportunities for teachers around need and use, not try to give them things that they don't think they want to know. So our training has been, "How do you use [Teachernet]?" Then if it's a science teacher, "How do I get the science resources from [Teachernet] that I need to get? How can I communicate with other people?"*

OEI offers several types of training, some for university credit, others for becoming familiar with Teachernet. Last winter, they offered Introduction to Teachernet, Networking I-Internet, Networking II-Dialog, Multi Technologies I: Classroom Applications. All training is voluntary (teachers self select into the training). Some districts give teachers release time to attend OEI training, but since much of the training is scheduled in the evenings and over the weekend, teachers must dedicate their own time. Teachers may audit any of the training at no cost, but must pay to get graduate credit. The training is organized to occur in concentrated chunks of time to facilitate teachers immersing themselves in the technology. Teachers are intentionally grouped to work in teams, much like their students will in the classroom. The tasks they are given to practice their technology skills are similar to the kinds of tasks that the teachers will be having their students do. For example, the training we observed involved 7th grade teachers from the two schools that participate in the Scholars Program. They worked in small groups with representation of teachers from both districts on a task that required them to track the relationship between population trends and tornadoes using a variety of Teachernet functions (e.g., creating a distribution list, sending mail, finding files in a drop box, printing output, and using Paintbrush).

Out of the 18,000 teachers whose districts are involved in Teachernet, approximately 4,000 received some type of OEI technology training. Enough staff have been trained, that schools are now beginning to do their own training. Teachernet does not do follow up site visits to schools, but they do have a help desk (see above) and on-line consulting.

- Involvement of outside experts

  Yes. Many experts are involved with Teachernet by serving as a Teachernet partner. For example, the list of partners includes six universities, Allied Signal engineers, Microsoft, a legislative education support and information network, and three phone companies. While these experts are not "outside," they bring the same types of resources to bear on networking issues. We know from our own experience, that OEI also draws on the expertise of research organizations such as SRI to assist in program design and evaluation.

- Creative fund raising

  Yes. OEI has been very successful garnering resources from Teachernet partners and others. Outside of funding per se, Teachernet has a very creative approach to supporting the association. The Teachernet Plan (1993) states:

  > *[Teachernet] also sets the stage for bartering services, resources and programs. Needs can be met, not with a dollar figure, but rather through a barter relationship among colleagues and clients. This extends the options for how we do business and allows greater equity to be established throughout the community.*

- Other strategies

1. Developing a set of formal and informal norms on students' use of Teachernet

   To address the problem described above concerning student access to inappropriate material, Eisenhower High School developed a 7-page Application for Account and Terms and Conditions for Use of Teachernet. The student user, his/her parents, and a sponsoring faculty member must sign it. The application/contract includes a discussion of "Netiquette"; for example, students are told to be polite, not to write or send abusive messages, use appropriate language, not reveal your personal address, password, or phone number, that the network is not private, and to use the network in such a way that it will not disrupt the work of others. In addition to the written contract, R.L. makes sure that both students and parents realize that inappropriate information will be accessible on the network.

   > *I tell them about what's out there and what they're not to access and if they get anywhere near it, to back out and go elsewhere. So they've been informed.*

According to both teachers and the students themselves, these norms are generally followed.

5.3 Facilitators

- Technical support on hardware/software

  Yes. OEI provides a help desk for any teacher or Teachernet member who has a question or a problem related to the TTS. According to W.T., systems management is where OEI staff spend 90% of their time.

  > *This doesn't mean managing the hard wires that go from there to there, but it does mean helping—giving the teacher, at that immediate point when they need the help, having the opportunity to get it....A teacher calls up and says, 'I can't get my modem to work. What do I do?' Or, 'I dial and dial and nothing happens,' or 'I can't get from here to there on the system.' So, to me, that's the technical assistance or the systems management.*

  OEI staff reported that the help line is busy from 7:00 to 8:00 in the morning and from about 9:30 to 2:20, "the phone rings constantly," despite the fact that OEI has a modem bank of 40 lines that teachers can get into.

- Teaching skills

  Unknown. Given the scope of Teachernet (18,000 teachers are involved), it would be difficult to determine whether teaching skills serve as a facilitator to Teachernet use. However, in the few instances that we observed teachers working with students who were actively accessing the system, they demonstrated good teaching skills (e.g., acting as a facilitator, promoting cooperative learning, linking assignments to real world problems students are interested in).

- Technical assistance on integrating technology into instruction

  Yes. OEI's main focus in providing teacher training on Teachernet is how to integrate the Teachernet activities in instruction (see above).

- Supported time for teachers to develop skills
  Yes, in some cases. According to W.T., "Sometimes the training is release time from the school districts. Sometimes the training is evenings and Saturdays. It's probably as varied as there are hours in the day." OEI training does include time for practice, but in terms of time once the teachers return to their home schools, it likely varies from district to district and school to school.

- Other facilitator
  Yes. Participating Teachernet districts and schools can access OEI staff to guide and assist them in preparing technology grant proposals.

5.4 Costs

Teachernet does not receive state or federal funding as a general rule (the Scholars Program is state funded, however, but does not represent a large portion of Teachernet's activities). Teachernet is supported through member fees ($.50 per student for original school districts, $.60 per student for new districts with local dial-up, and $.60 per student plus the cost of a long distance call or a bundled service if outside of the metropolitan area), resource partner fees (from 0 to $750 depending on the partner's level of contribution), other contributions, and grants. From 1989 to 1993, Teachernet and its partners generated funding of $1,666,000.

6.0 Impacts

6.1 Effects on Students

Note, much of the information on student effects was taken directly from the students themselves in the context of a focus group.

- Motivation
  Yes. All of the students we talked with in our focus group indicated that they were more motivated to complete a research related topic if they could use the Internet, instead of the library. They were confident that their work would take less time and be of higher quality. Students also knew that computer skills were essential for college and that soon all careers would require computer expertise. They thought that the more they learned now, the more it would help them in the future.

R.L., who teaches the electronic research class, observed that students in his class stay on task most of the time and stay with their task. The principal reinforced this point. He said that teachers tell him that when their students are on Teachernet, they seem to be able to stay on task longer.

- Self-esteem
  Yes. One student said that using the Internet to help with her research gave her a sense of confidence. Both she and her teacher were very impressed with the breadth of her sources and the information gathered. The student said that it was easier to convince herself that she had done a comprehensive review of the sources by doing her research with the computer because she truly believed that the Internet contained all of the important sources. In general, all of the students seemed to take pride in their extensive knowledge of computers and the Internet. A few noted that sharing their Internet research skills with teachers "could easily endear them to teachers over the long run."

- Attendance, retention, disciplinary rates
  No. There was no evidence that the Teachernet experience helped raise or lower attendance, retention, or disciplinary rates.

- Technology skills
  Yes. Many of the students we spoke with had acquired advanced computer skills, and know more than the most knowledgeable of teachers in the school. Some had even bought modems for their home computers so they could access the network from home.

- Other
  (1) Encourages critical thinking/problem solving
  Yes. Students reported that using Teachernet, and especially access to the Internet, creates a certain questioning type of atmosphere by allowing them to see how much information is really out there. There is so much information that they have to think hard about what they really need and how they will use it.

C.A., the social studies teacher, felt strongly that networking teaches students very important generic research skills that they will use for the rest of their lives.

> *Gathering data is a skill, a social studies skill, a science skill. How do you gather and understand information? And that's a skill taught through networking. How do you problem solve? That is a networking skill. How do I make good decisions in a democratic society? Because the Internet requires good decision making.*

6.2 Effects on Teachers

- Inclination to assign complex tasks

  None of the teachers we spoke with said that using Teachernet with their students had an effect on the complexity of the tasks they assigned. However, the tasks that they described (see Section 4.2) involved searching for, collecting, and collating vast amounts of information—much more than would be involved in a typical library search. The sifting and sorting through of information in order to decide what is most useful for the task at hand is, by its nature, a complex endeavor.

- New instructional strategies

  Yes. Using Teachernet with students has clearly changed the way most teachers teach. Take R.L., who teaches the electronic research class:

> *I was definitely a sage on the stage when I started, and taught math for 12 years and I was the center of the curriculum and the center of the learning, I thought. And as soon as I got into computers, I found out, oh, you know, I really don't need to be up here showing them everything. There's a lot of things they can learn on their own. In fact, they're better off learning things on their own and discovering things.*

Normally, R.L. says that he will present something for about a half hour, and that's the last time the students will have seen him demonstrate for another week. Then when they need help, he tries to give them support. He also reports the way he assesses students has changed. "They do have a product to produce and when they produce it at 80% mastery, then they get credit and I give them an A, which is called 'acceptable.'".

Another teacher involved in Teachernet with his students said that networking has changed his teaching only to a limited extent. He is more focused on how teaching will change when more teachers have access to Teachernet.

> *I have some visions...and when that vision comes to life, it's going to change everybody's teaching. But that's going to require a computer on every teacher's desk. It's going to require effective local area and wide area networks. It's going to require efficient easy to learn point and click Internet access. It's going to require a user-friendly Internet that's not out there yet but I think it's going to be out there.*

Another teacher who is on the technology committee believes that teachers will definitely need to change their teaching once they become more involved in using Teachernet in their classrooms. He pointed out that most teachers are very much into auditory learning versus visual learning, and this generation of kids are visual learners. But he recognizes that change of teaching style is scary.

> *Its scary for them you know, because they've done this for 20, 30 years and then suddenly someone says, 'There's another way,' and they're saying, 'But I've done it this way for so long now. It worked for me.' You know, so I say, 'It may work for you, but is it working for your students?*

Another way that teachers change in using Teachernet is that they have to become comfortable with learning from their students, especially at the high school level. J.N., the debate coach, thinks that teachers have to surrender to the fact that we live in a time and age where students can get more knowledge about computers and technology than the teachers can. This, he pointed out, is hard for many teachers to accept.

- Self-esteem and sense of professionalism

Yes. W.T. often uses teachers to teach Teachernet courses. She noted that this was the first time that has ever been done around the area.

> *Sometimes a teacher's not the hero in their own home town, so you may want to take that teacher and they become very valuable to you in a different environment.*

W.T. herself has played a mentoring role with several teachers. During our visit, she took R.L. along with her to Washington, D.C., to make a presentation on his Teachernet application (the electronic research class). R.L. has begun to train teachers at his own school and says that he gets a lot of satisfaction out of sharing his expertise with other teachers.

- Communication with other teachers

  No. We did not come across many examples of teachers using Teachernet for communication purposes. This is undoubtedly related to the fact that, with rare exceptions, teachers do not have their own e-mail addresses.

- Use of time

  Yes. Several teachers said that using Teachernet to obtain supplementary materials for their classes saved them time because they could access Dialog and the Internet from home, rather than having to do research during school hours.

6.3 Effects on School Climate & Processes

- Increased linkages with outside organizations, resources

  Yes. The 450 schools that are part of Teachernet are linked to one another, to OEI, and to all of Teachernet's resource partners. Beyond these local resources, Teachernet itself, by providing access to Dialog and the Internet particularly open the entire world of resources to participating schools.

- Enhanced role as magnet

  Does not apply.

6.4 External Accountability Measures & Their Influence

There have been no external accountability requirements for Teachernet thus far, probably due to the fact that OEI has historically received no state or federal funding.

6.5 Evaluation

OEI evaluates their teacher training activities via on-line time surveys and post training questionnaires. According to the use data, on average, teachers access Teachernet 5 hours per month. Of the 4,000 trained teachers, W.T. estimated that about half are really frequent users. The participant evaluations include participants' perceptions of their knowledge and skill level across various Teachernet applications and their evaluation of various aspects of the workshop experience. We were not aware that Teachernet had conducted an external evaluation of its services or the impact of Teachernet participation on member districts.

The Scholars Program that Teachernet sponsors is being evaluated "informally."

- Test scores
  Not applicable

- Retention rates
  Not applicable

- Attendance
  Not applicable

- Discipline rates
  Not applicable

- Teacher turnover
  Not applicable

7.0 Reflection and Advice

7.1 Dissemination

OEI acknowledges that participating districts vary greatly in their level of utilization and the nature of their utilization. W.T. and other OEI staff noted that a district's level of resources is unrelated to its use of Teachernet. OEI does no marketing of its services or Teachernet, aside from their user newsletter. However, they do try "to get the word out" informally.

7.2 Plans

With respect to the Teachernet teacher training, OEI is now addressing two issues: (1) What are more advanced uses of the Internet? and (2) What types of training would inform schools the most? Teachernet's long term goal is to establish direct connects to the Internet for each school which would greatly facilitate access and speed up communications. They are discussing wireless Ethernet as one alternative to additional phone lines, which would be very expensive. They are struggling with the fact that there are few models for schools to establish direct connects. Schools differ in significant ways from businesses (e.g., they do not own the land between buildings) for which models are available.

7.3 Advice

OEI staff and Teachernet members feel that they are still learning the best ways to make networking feasible and productive in the school setting. They did not have any specific advice to give others, but welcome any that network specialists would give them.